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Features FOR MARCH, 1951

The Cover:
In a vivid visualization, Artist Denver Gillen shows what an A-Bomb blast may do to your home.

Shaw Tries Out the New Buick....100
The new "special" Special takes the hills and bumps and comes through with flying colors.

How Good Are Russian Guns?.....107
Captured samples show that calculated crudity is the real secret of Red arms and logistics.

How to Build a Family Foxhole....113
This condensed PS Handbook is a down-to-earth guide to family A-Bomb survival.

Skiing Fans Get Manmade Snow....127
A machine that works like your refrigerator makes snow while the sun shines.

Chrysler Unveils New V-8.....134
The world's most powerful passenger-car engine has high compression but uses regular gas.

TV Takes Over Test-Pilot Job.....144
The test pilot of some fast, new fighter may be sitting miles away—watching a TV screen.

New Paints for the Handy Man....153
There are multicolor enamels, rubber-and-water paints, and coatings that look like suede.

Popular Up-and-Down Theater....179
Here's competition for TV—a home theater for use with either puppets or marionettes.

Turning Space into Rooms.....184
Part II of "The Inside Story of Our Expansion Attic" tells of studs and plasterboard.

Paint Grains Metal Surfaces.....222
With a few tools and a little practice you can make any paintable surface look like wood.

Termites Can Be Defeated.....227
These deadly enemies of your house can be licked by a well-planned counterattack.

Tiny Tuner Is Bedside Radio.....233
Here's how to hitch three tubes to an amplifier to get quality superhet performance.

Small Plane Carries Litter Patient.....112
Air Force to Get Turboprop Transport....120
Here Are Jets Under Two Flags.....122

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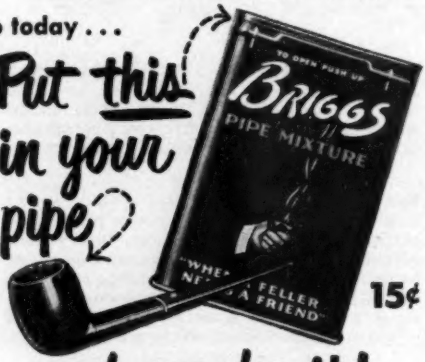

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Swiss Bus Runs on Flywheel Power.....124
Big Bertha Beams Radium.....131
Floor Machine Does Three Jobs.....133
Employees Win Cash for Inventions.....141
Cargo Conveyor Zippers Up.....149
British Fords Get U. S. Look.....150
50-Foot Tape Reels Itself In.....152
Movies Projected from Nonstop Film.....157
Biggest Air Freighter Goes to War.....158
What It's Like Inside a "Hot Lab".....160
Inside Story of a Big Glass Furnace.....163
Here's What Yankee Ingenuity Means....164
New Army Machines Go by Air.....166
Tricycle Car Borrows Plane Ideas.....168
Workshop Tricks for TV Audiences.....173

Mechanics & Handicraft

Cobbler's Bench Holds Smokes.....191
Gus Finds Two Rights Make a Wrong....192
Buying a Used Station Wagon.....197
Seats Built into TV Set.....202
What's New in Boat Kits.....208
See Cosmic Rays in Your Kitchen.....210
Cut-Out Chairs Cut Cost of Comfort.....213
Photography Pays for My Flying.....216
Tube-Fitting Tools You Can Make.....220
Wall Shelf Has Electric Outlet.....225
Hang Up Your Ironing Board.....226
Lunch Carrier for Your Car.....232
Trailer for Garden Tractor.....241

Departments

Letters 12
New Ideas from the Inventors.....105
Keeping the Home Shipshape.....171
Aids to Modern Living.....176
I'd Like to See Them Make.....178
Hints from the Model Garage.....195
New Shop Ideas.....238
Mechanics of Farming.....250
New Tools.....276
P. S. Last Minute News and Notes.....280

How You Can Fight Radiator Saboteurs

THREE destructive forces—rust, scale, and electrolytic corrosion—are riding in front of you in your car. They will steal efficiency from the cooling system if you give them a chance. Next month two companion articles in POPULAR SCIENCE will tell you how these saboteurs work and what you can do to thwart them.

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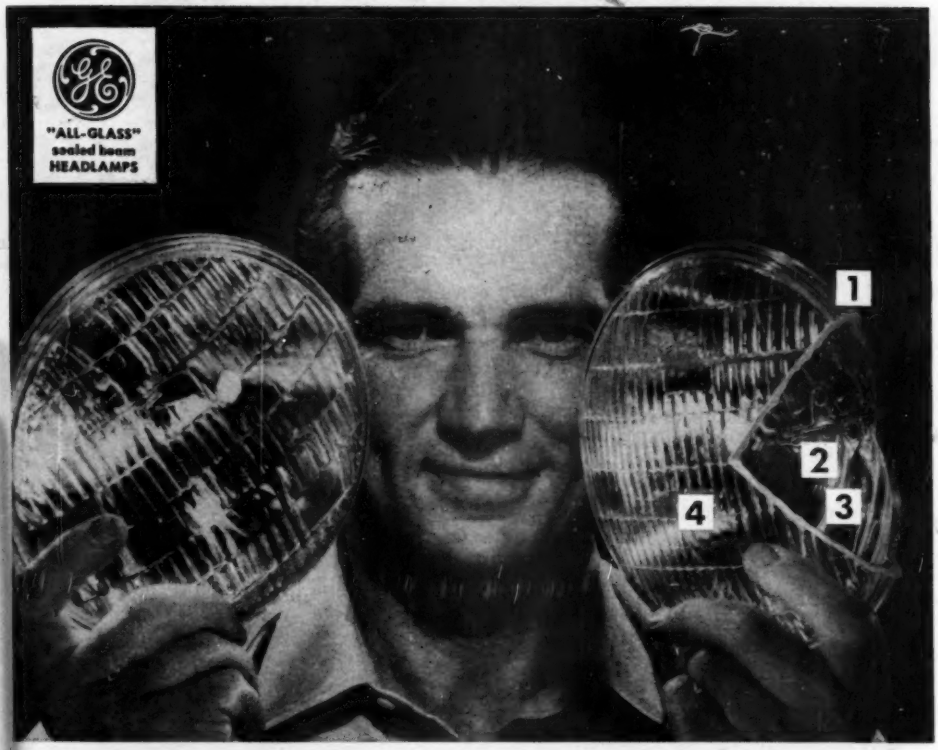

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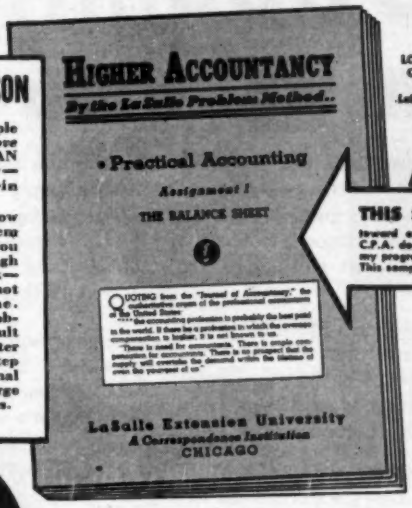

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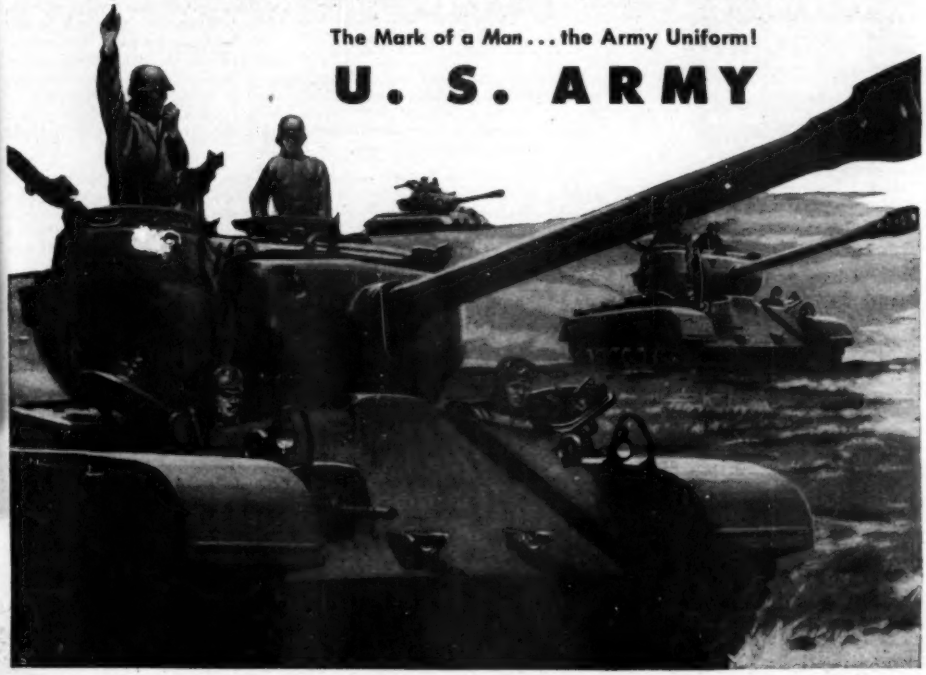

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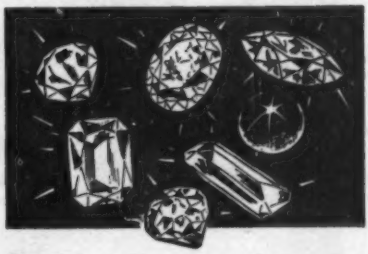

Here Is Exactly HOW And WHERE To Find Them

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Last year alone, over half a MILLION dollars worth of stones were found by week-end gem hunters. A youth pitching horseshoes in an open lot picked up a stone and kept it in his pocket for 15 years before he discovered it was the largest alluvial diamond ever found in the U. S.—34.46 carats in weight. Two salesmen went gem-hunting on vacation and found a small pocket of "Tourmaline," a semi-precious, crystal gemstone, worth $13,500.

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(as Wm. P. Jones of West Va. did)

Would YOU Know It Was a 34.46 Carat Diamond? (see story at left)

Are You "Passing Up" REAL GEMS Near Your Home?

Valuable gems are all around us—half hidden by surface dirt and other rock. Perhaps in an abandoned quarry near your home, a river bottom, a rocky hillside, a beach, or an old cave. If you know WHERE to look and how to RECOGNIZE the more precious stones—you can enjoy an educational hobby that can pay off BIG.

Now you can enjoy and profit by gem-hunting—no matter where you live in the U. S.! Brand-new book, "Gem Hunter's Guide" tells all you need to know. Exactly where to find scores of precious and semi-precious gems. Where to find rich PEARL-bearing mussels. Complete town-by-town and gem-by-gem cross-index helps you plan week-end and one-day gem hunts. How to recognize each variety—clear photos of gems in their natural state make it easy. Simple tests you can give the rocks you find, plus 1350 locations where gem materials have been found all over U. S. A. and a special chapter on how to identify quickly 69 different and valuable gemstone varieties. Book is handsomely bound and contains over 200 pages packed with illustrations, photos, maps, charts, etc.

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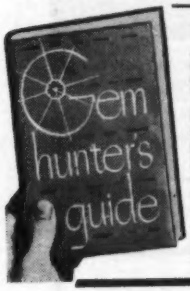
Do You Know That:

- Big, valuable, perfect Pearls have been found in many sections of the U. S.
- 48,000 Diamonds have been found in Arkansas alone?
- A Diamond weighing over 20 carats was found in Virginia?
- A vast region surrounding the Great Lakes possesses the greatest store of Diamonds yet to be found in the U. S.?
- Gem sapphires are found in Colorado, Idaho, Montana, New Jersey, New Mexico, and North Carolina.
- For every Diamond already found in this country, there are thousands more yet to be found?
- A cowboy found an Opal worth $280,000?
- Mid-west streams have produced as much as HALF A MILLION dollars worth of Pearls in a single year?
- A ten-pound Turquoise nugget—believed largest ever found—was discovered recently in one of our western states.
- Valuable Gems are discovered in all parts of the U. S.—even in New York City area?



TELLS YOU—

- Many ways to test rocks to see how valuable they are: color tests, hardness and specific gravity tests
- How to plan a weekend gem-hunting trip
- Locations where gem materials are found IN EACH STATE—complete town-by-town index; also gem-by-gem cross-index giving town and county
- Where rubies are found in Georgia, Idaho, New Jersey and No. Carolina
- How to make drab rocks glisten like magic with "black light"
- How to identify over 69 different gem materials by hardness, composition, color, luster, cleavage, associated rocks, etc.
- Methods for classifying gems by families
- Where diamonds, pearls and rubies have been found in the U. S.
- A simple plan for finding and harvesting pearl-bearing mussels
- That gem quality emeralds may be found in Maine, Massachusetts, New Mexico, and North Carolina

—Also special illustrated portfolio of various gem materials in natural state

Science and Mechanics Magazine, Dept. 753
450 East Ohio Street, Chicago 11, Ill.

Please send me—for 10 days' FREE EXAMINATION—the brand-new "Gem Hunter's Guide." Over 200 pages, handsomely-bound, and packed with pictures, maps, charts, expert advice. Unless completely satisfied with book at end of 10 days, I may return it and owe nothing. Otherwise, I will keep it and send you only $2.95, plus 25c to cover postage and handling charges.

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What Strange Cosmic Power Influences Humans?

BY WHAT RIGHT does man presume that he is the chosen being of the universe and that the earth alone shapes his existence? In the infinite spaces above, tenanted by vast and magnificent worlds, are Cosmic forces which influence the life of every mortal. As iron filings respond to the attraction of a magnet, so too, your acts are the result of an impelling influence upon your will. Just as the unseen Cosmic rays give the earth form and substance, so too, from the infinite reaches, an invisible subtle energy affects the thought processes of every human. Life itself bows to this strange universal force—why, then, should YOU not understand and COMMAND IT? You are like a pendulum either to be swung forward to happiness and the fulfillment of your dreams, or backward into discouragement and disillusionment. Why remain poised in a state of anxiety, uncertainty, and anticipation? Learn to draw to yourself these Cosmic forces which will give your mind the creative impetus that will assure the end in life you seek.

For You — A Gift Copy of the Sealed Book

Not for the curious nor the skeptical, but for the modern man and woman the Rosicrucians, a progressive movement of thinking persons, offer a free, Sealed Book, telling how you may acquire the truth about these phenomenal Cosmic powers little understood today and which make for freedom and attainment in life. THIS IS THE DAY AND AGE OF MASTERY. Throw off the age-old custom of—"let life be as it may"—and learn to *create it as you wish it.*

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Fill cracks in chairs—

Makes loose joints firm, sands to a smooth finish!

Reset loose hinges—

Replaces rotted wood, tightens loose screws . . . *easy* to apply!

Repairs broken toys—

Mend cracks, nicks! Smooth finish!

Also useful in filling cracks in floors, nail and screw holes, repairing loose tiles. *Handles like putty . . . hardens into wood!*

PLASTIC WOOD

A CELLULOSE FIBRE FILLER

IN CANS OR TUBES

DOZENS OF OTHER USES

Letters

Cooking Gas Still Cooking

Sir:

With reference to your article in the December issue, "Fill 'er Up with Cooking Gas," I would very much like to obtain additional information regarding liquefied petroleum gas.

I live in northern New Jersey and own a 1949 Chevrolet. Can you tell me if it is possible to obtain this gas in this locality, where I might purchase the parts for conversion, where I could have them installed, and the approximate cost? . . .

JOHN THURAUF

New Milford, N. J.

Sir:

. . . Where may I obtain information in regard to equipping a pleasure car or farm tractor to run on LPG? . . .

RICHARD U. PLATNER

Granger, Ind.

Sir:

. . . I would like to convert my '42 Pontiac and also my '50 Studebaker truck. . . .

Z. P. LEWKOWSKY

Key West, Fla.

Sir:

. . . I have a '42 Buick Special with single carburetor. Does it have correct compression ratio? Is LPG available? . . .

W. L. KARLSON

Nickleton, N. J.

Sir:

. . . I am interested in applying bottled gas to my '50 Oldsmobile and Ford. . . .

A. L. KIMBALL

Bangor, Me.

LP Gas is most useful at the present time to large fleets of commercial vehicles that can take advantage of central sources of supply and maintenance facilities. But for the pleasure-car user, there are still some problems. Here's the latest word on the situation as reported by the Phillips Petroleum Company.

1. As yet, there is no distribution of LP Gas for passenger-car use—you can't stop in

INVENTORS

Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

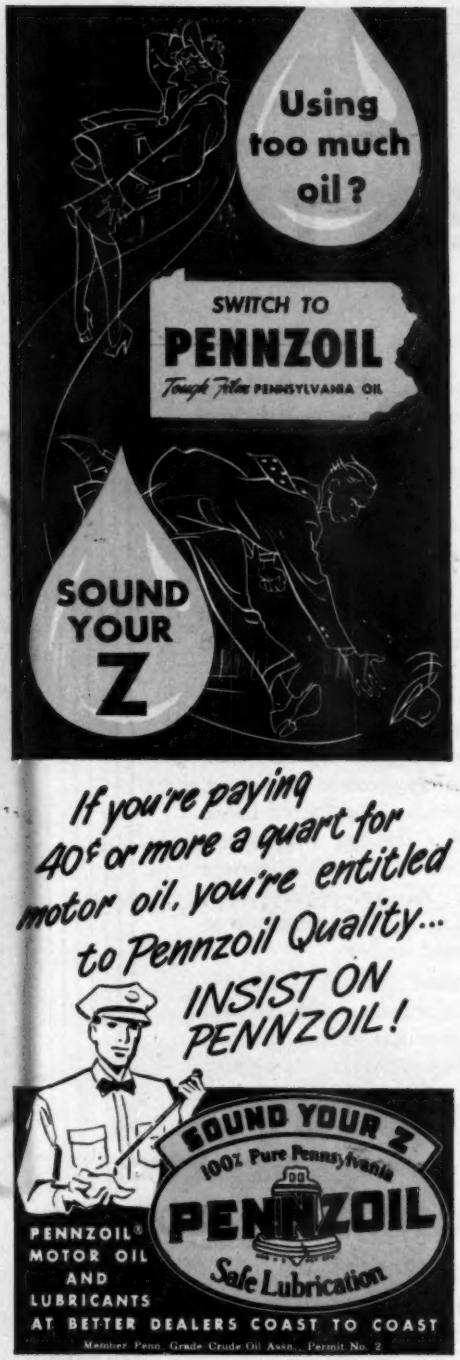
A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

CLARENCE A. O'BRIEN & HARVEY JACOBSON

Registered Patent Attorneys

12-C DISTRICT NATIONAL BUILDING

WASHINGTON 5, D. C.



at just any filling station and tank up—so getting LPG would be a major problem.

2. The cost of conversion is still so high—$150 to $200 for parts alone—that even the long-run saving would not make up the difference during an average car life.

3. At present, garage mechanics are not trained in the handling of LPG equipment, so maintenance and repairs would be another problem.

4. It is possible to buy a combination carburetor that will let you use either LPG or gasoline—which might solve the LP-shortage problem—but unfortunately an engine cannot operate efficiently on both fuels without delicate adjustments for each one. A spark setting that would be right for LP would probably be excessive for gasoline.

5. The only actual changes required for conversion are in the fuel-storage tank, the fuel line, and the carburetor. But if no additional changes are made in the engine itself, fuel consumption will be about 10 percent higher on LPG than on gasoline—which, of course, will eat up your saving. There may also be a slight power loss.

6. Because of the pressure of LPG, it must be stored in a bulky, cylindrical tank. About the only place to put this in present cars is the trunk, which renders it useless for carrying luggage.

7. Finally, LPG is tricky stuff. In inexperienced hands, it can be dangerous.

Rose with Built-in Thorn?

Sir:

I note that one of your contributors would like to see them make magnetic steel tapes for measuring pipe [Dec., p. 148]. It is quite

possible that if he had one, he would spend most of his waking hours picking off steel chips, filings, etc.

C. E. Hobart

Bridgeport, Conn.

Kite-Flying Challenge

Sir:

In your November issue, on page 128, I read about Charles H. Baum claiming a rec-

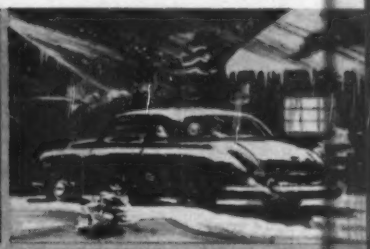
ELECTRICITY LEAPS from storm clouds to top of Empire State Building as shown in this dramatic night photograph. Engineers harness electrical energy like this to "fire" gasoline in your engine.

Scientists Create "TAILORED LIGHTNING" For Better Motoring

In the great engineering laboratories of The Electric Auto-Lite Company in Toledo, Ohio, a group of Auto-Lite Ignition Engineers have been probing inside engine cylinder walls, peering at "blow-by-blow" spark performances, charting the behavior characteristics of man-made "lightning" across the spark plug gap. From endless tests they've determined what your engine's ignition system needs most, and then set about producing spark plugs to fill the bill. Net result: Ignition Engineered Auto-Lite Spark Plugs . . . the spark plugs that are *world famous* for quality and performance.

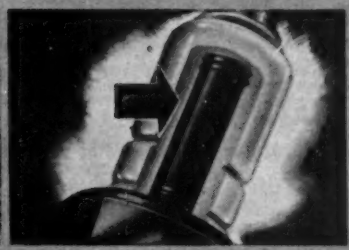
FRANKLIN'S KITE experiment was first demonstration of electrical nature of spark discharges between clouds. Date: 1752.

"FIRING PIN" of the car engine. Your spark plugs fire as many as 15,000 fuel charges per minute with tailored precision.



RELIABLE STARTING is one important benefit resulting from Auto-Lite research to assure correct materials, dimensions and design

RIVER CUTTING CANYON resembles way surging of electricity wears away electrodes. For solution see next picture.



TINY UNIT called a "Resistor" permits wider initial gap setting, makes possible these advantages of Resistor Spark Plugs:

All car, truck and tractor owners benefit from the exhaustive research performed by Auto-Lite Ignition Engineers . . . the men who design the coil, distributor, spark plugs, wire and all the other parts of the complete ignition system used as original factory equipment on many leading makes of America's finest cars and trucks. *You're Always Right With Auto-Lite.*

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Toledo 1, Ohio **Toronto, Ontario**

*Double life under equal service conditions when compared to spark plugs without a built-in resistor.

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AUTO-LITE
SPARK PLUGS

with these Wizards with Wood

Do you get a kick out of making things with wood? You'll rave about the dandy new effects you get with these time-tested products. . . .

A MUST for Finishing Fir Plywood

Tame that wild grain with FIRZITE. It tight-seals the pores . . . virtually prevents grain rise or checking . . . readies the surface satin-smooth for paint, stain or enamel. (For blond, pickled, wiped or tinted effects use White Firzite).

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For "natural wood" finishes on furniture or woodwork, there's nothing like Satinlac. Brings out the natural grain and color beauty of any plywood or solid wood. Avoids that "built-up" look, and will never turn yellow or darken with age. "Water-white", easy to brush or spray, dries ready for next coat in 2 or 3 hours.

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Glue That's Stronger than Wood

To make things or fix things, use Weldwood Glue for all wood-to-wood bonds. Makes joints stronger than the wood itself. Mixes easily with water. Stain-free, rot-proof . . . highly water-resistant! 15¢, 35¢, 65¢, 95¢ and larger sizes.

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ord by flying 75 kites on one string. I hold a record of 108 kites on one string. And I

make my own kites as a hobby—seven different kinds. They have no tails, and must fly perfectly or I destroy them.

Now I would like to arrange a contest between this other fellow and myself to see who's really the champion kite flyer.

CHAS. H. LOHSEN

East Paterson, N. J.

We are forwarding Mr. Lohsen's challenge to Mr. Baum—who lives in Summit, N. J., only 20 miles away—and will be glad to print the results of any contest they can arrange.

Novel Drive Had Ancestor

Sir:

In your November issue, page 124, there is a lengthy article about giant radial engines . . . The outstanding feature appears to be a method of articulating the connecting rods to the crankpin, which we are given to understand is something new.

As an aviator in years past I have often flown behind an engine which employed that same device, known as a geared cage system. The engine was known as the Salmson . . . "

STEPHEN CHUCK

Canora, Sask., Canada

Reader Chuck has a longer memory than PS's.

More than three decades ago, Salmson aircraft engines (built by the Société des Moteurs Salmson of Billancourt, Seine, France) pioneered in employing a geared non-oscillating drive plate. The novel drive was superseded by a conventional one in Salmson engines of World War I vintage and later. But its ingenious principle reappears in the modern Nordberg drive for stationary radial engines.

Metal vs. Battery Water

Sir:

You'd better think again about that tip in

INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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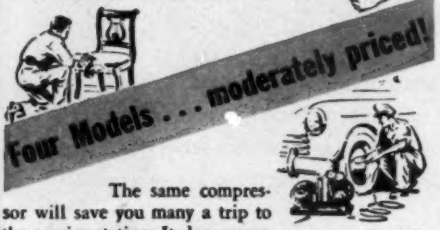

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All Campbell-Hausfeld air compressors are piston type, precision built with deep cooling fins cast integral with cylinder block. Cylinders are honed to mirror finish. Crank shaft is drop forged automobile steel, heat treated. Valves are disc type, stainless steel.

Every C-H compressor is rechecked by run-in on test line before shipment. Lasts a life-time.

PRESSURE QUEEN the only 4-cylinder portable outfit.

No Pulsation

Write for complete specifications and price list.

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Send literature and prices on complete line

Name_____

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My dealer is_____

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your Model Garage section for December [p. 178] on using a whipped-cream container to make a funnel for filling a battery. Isn't battery water supposed to be kept in earthenware, glass, plastic, or rubber containers? And isn't the whipped-cream container made of tin or steel?

ED KOSAR

Belleville, Ill.

Battery water should be stored in non-corrosive containers; but we doubt that there would be any measurable contamination from a metal funnel during the few seconds it takes to fill the various cells.

TV Tubes Are Touchy

Sir:

Though I am sure you are aware of the danger connected with handling a television tube, I have never seen any warning as to the care that should be observed while in contact with the tube. . . . I would suggest that you publish a warning that those people who have TV sets should not fool around with them.

R. J. HASBROUCK

Teaneck, N. J.

See "Why Call a Television Serviceman?" in POPULAR SCIENCE *next month.*

Doman Developments

Sir:

How are Mr. Doman and his helicopter getting along? I read about this unusual 'copter, with its tilting rotor head, in PS for November 1949 [p. 158] but haven't heard or read anything more about it.

I was interested in your article because I am interested in helicopters in general, and this one looked to me like a long step forward. Also, I had been mulling over an idea for a similar control system, although from an entirely different angle.

J. A. HIEBERT, JR.

Arcata, Calif.

Right now the Doman company is working on a military version of its helicopter for the armed services. This machine, powered by a Lycoming engine of about 450 hp., is being built in conjunction with Curtiss-Wright. The 'copter will be used for liaison and rescue. Doman also plans a commercial version to carry 12 passengers.

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BRIGGS & STRATTON 1.6 h.p., 4-cycle engine. Famed TIMKEN BEARINGS. "STA-TEMP" BLADES, specially hardened to stay sharp longer. FULLY ENCLOSED CHAIN DRIVE. Convenient FINGER-TIP CONTROLS. Special GRASS GUARDS to prevent grass from winding at ends of reel. FREE FLOATING HANDLE to minimize ground-shock and vibration. LARGE HEAVY-DUTY TIRES.

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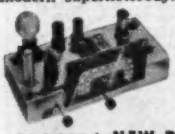

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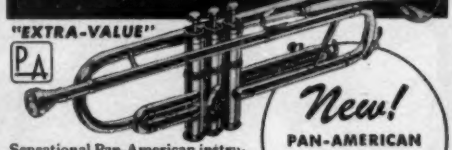

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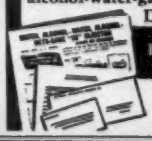

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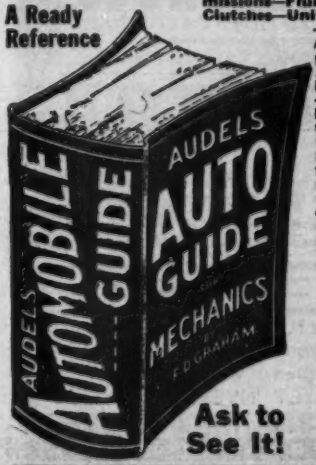

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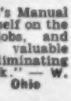

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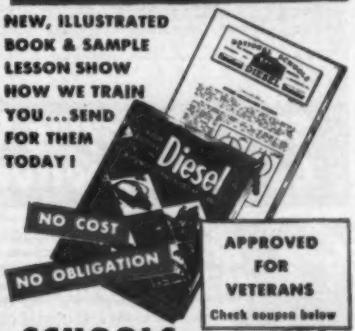

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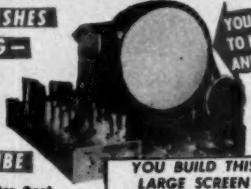

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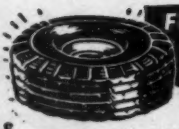

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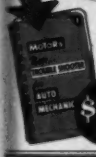

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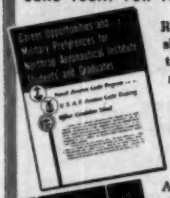

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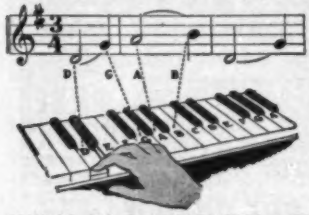

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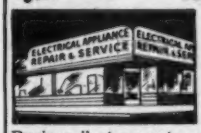

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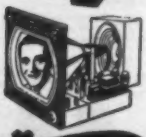

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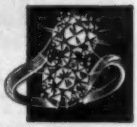

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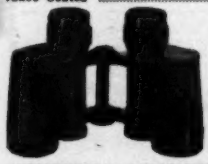

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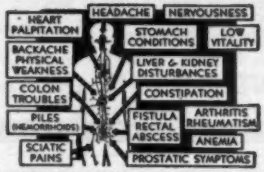

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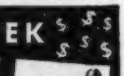

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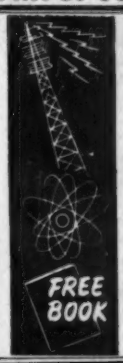

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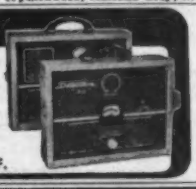

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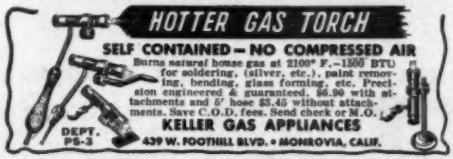

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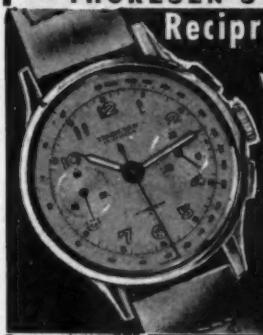

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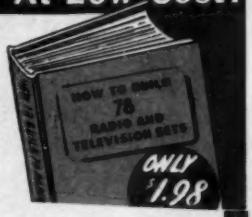

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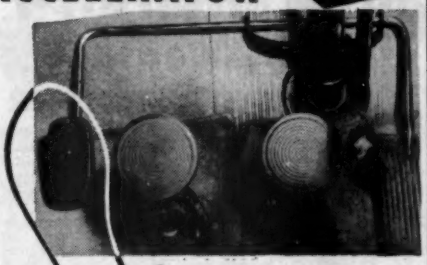

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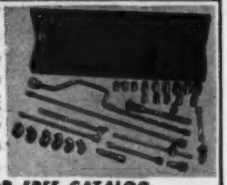

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700-16	7.94	700-15	6.54	700-20	12.94	1100-20	22.54
750-16	8.94	710-15	6.34	32x6(8)	12.54	1000-22	19.54
550-17	5.94	760-15	6.54	32x6(10)	13.94	1100-22	20.54
525-18	5.54	820-15	7.04	750-20	12.54	1200-22	24.54
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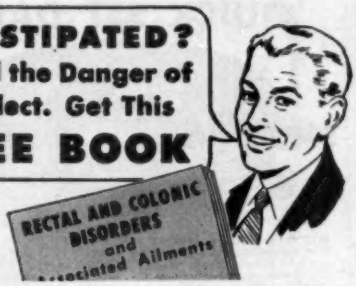

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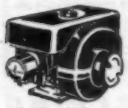

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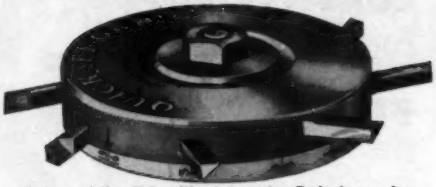

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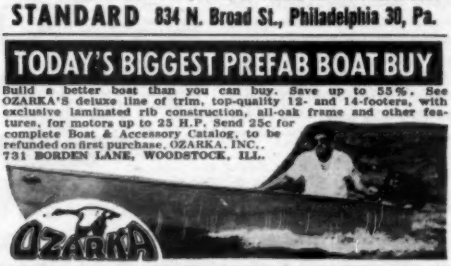

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MAKE Money At Home—Ideas galore to choose from. All fully illustrated and described. Write: Spens Distributors, Box 5511-S, Chicago 7, Ill.

HOMEWORK—Addressing—Envelopes—Details—25c. Siegel—P.O.B.—183—Knick.—New York 2.

BE income happy. New local and mail selling opportunities. Free literature. L. Mallory, 266E South Court, Neillsville 6, Wis.

MAILING postcards selling repeat merchandise is profitable. Everything supplied. Details free. Gordon Publishers, Box 23, Pawtucket, R. I.

"EARN While You Sleep." Coin radios. Johnny Kratz, Grantham 27, Penna.

$124.50 WEEKLY. Guaranteed! At Home, Sparetime. $1.00 Deposit. Science Syndicate, Box 621, Columbus, Ohio.

BOOKKEEPERS earn $100.00 weekly operating simplified "Bookkeeping & Tax Service." Details Free. Universal Bookkeeping, Box 664-P, Springfield, Missouri.

MAKE money making new greaseless doughnuts at home on electric machine. Wholesale to grocers, drug stores, cafes, hamburger shops. Send for free recipes and plans. S. Ray Company, 3605 South 15 Ave., Minneapolis 7, Minnesota.

FREE illustrated directions casting novelties. Genuine latex for molds. Major Chemical Co., 164 Portland St., Cambridge, Massachusetts.

ELECTROPLATE Metals and Non-Metals with the Tyco Electro-Plater! Portable. Inexpensive. Profitable Home Business. Free Booklet. Tyco Metals, Box 13231-P, Houston 19, Texas.

COLORGLAZED Concrete Pottery made without molds. Patented method. Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries, Grand Rapids, "Minnesota"

HAVE Your Own Business, Big Earnings Local And Mail Order Get The Facts. Crittenden, Lombard 11, Ill.

MAKE Perfumes at home, write, "Carey Laboratories," 1914 Chouteau, PS-B3, St. Louis 3, Missouri.

FREE Illustrated course casting novelties. Genuine latex for molds. Major Chemical Co., 164 Portland St., Cambridge, Mass.

EARN Money At Home With Your Typewriter! Spare time! Details free. Edwards, Publisher, 3915-PS, 12th, Des Moines 13, Ia.

INVISIBLE Reweaving—big profits, big demand, easy-to-learn with low-cost complete course—nothing else to buy, ever. Details free, write today: Fabricon, Dept. K, 8342 S. Prairie Ave., Chicago 19, Ill.

WOULD You pay 3%—first $350 made? Book "505 Odd Successful Businesses" free! Work Home. Expect something odd! Pacific-SS, Oceanside, Calif.

DEFENSE welding jobs pay. Welders needed. Train quickly. VA contract. Hobart Welding School, Box P-315, Troy, O.

BUY 550,000 articles. Directory 10c (refundable). Publishers, Box 1302-A3, Detroit 31, Michigan.

RUBBER MOLDS! 50 Different! Dollar up! Illustrated lists free! Castcraft Studios, 508-S Marion St., Brooklyn 33, N. Y.

BEAT Inflation. Wartime Plans! Free Book "372 Unusual Worldwide Businesses." Work home. Start sparetime! Publishers-SS, Carlsbad, Calif.

"ELECTROPLATING-Know-How" includes baby shoe, chrome and brush plating; other lucrative fields. Learn easily. Free booklet. Joseph B. Kushner, Electroplating Engineer, Stroudsburg 53, Penna.

MAKE money by mail. Easy, big profits. Everything furnished. Write—Thomas' Service Enterprise, P.O. Box 56, Brooklyn 28, New York.

$46 FROM Square Foot Plywood: Jigsaw necessary. Write: Woodart, Bridgewater, Massachusetts.

WHERE To buy 600,000 Articles Wholesale. Details Free. Krueger, 3418 Wolcott, Chicago 13.

MANUFACTURE your own Rug, Upholstery Shampoo. Free details. Ohio Chemical Products, 1111 Dougherty N.W., Canton 3, Ohio.

PRINT without Printing Press—posters, banners, greeting cards, toys, glassware, neckties—anything! New "easy" Revolutionary Method. No special equipment or experience needed. Work full or spare time at home. No selling. We set up "your own local business." Wonderful $$$$$$$ opportunity. Free sample, profitable ideas, beautifully illustrated plan free. Write Screen-Print, 1010 B Los Angeles Street, Los Angeles 15.

UNPAINTED Figurines, Lamp Bases. Finest Selection. Write For List. Wells' Decorative Arts, 3632 W. Flagler, Miami, Florida.

BUY it wholesale. Manufacturers, Distributors. Over 850,000 items. Literature free. Olsen, 1231-B East Third St., Duluth 5, Minnesota.

YOUR ad here will be seen by 3,992,000 potential customers. Cash in on this great mail-order market today!! Closing date for May issue is March 26th. For free information and order blank write O. K. Kelly, Classified Adv. Mgr., Popular Science Monthly, Dept. M-6, 353—4th Ave., New York 10, N. Y. Also request our free booklet on "How to Make Money out of Classified Advertising."

57 MONEY MAKING OPPORTUNITIES

INDEPENDENT income! Make leather belts, billfolds, purses. Big catalog and genuine steerhide keyholder, 10c. Tandy Leather, Box 397G, Tulsa, Okla.

$5 HOUR Easy! Sell name plates for houses. Free Sample, order blanks. Write: National, 214 Summer, Boston, Mass.

DETECTIVES Earn Big Money. Experience unnecessary. Detective Particulars free. Wagoner, P-125 West 86th, N. Y. 24.

SCHOOL Seniors — Earn sensational profits selling classmates America's Most Beautiful Graduation Name Cards. Largest selection. Outsells all others. Free sample kit. Printeraft Dept. P, 1425 E. Elm Street, Scranton 5, Pa.

QUICK profits taking magazine subscriptions, handling greeting cards. Cassell Publishers Service, Westfield, N. J.

RAISE your business value, standing, as State Notary Public. Information. Stationers, Helotes 50, Texas.

NEW Batteries From Old. Make Quick Money. L. Wertz, Pekin, Ill.

EARN Extra Cash! Get quick profits. Make pearl and rhinestone jewelry! It's easy! It's fun! Sells On Sight! For complete instructions and illustrated catalog send Only 10c to cover mailing and handling to Immerman & Sons, 1812D3 E. 13th St., Cleveland 14, Ohio.

WIN contest money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1600-A, East 5th, Duluth, Minnesota.

$35 WEEKLY! Home! Two hours daily! Twenty-seven unusual ways! Walsh, 894 Main, Buffalo 2, New York.

MEN, Women. Grow Mushrooms. Cellar, shed. Spare, full time, year round. We pay $3.00 Lb. We Paid O. Babbitt $4.165 in few weeks. Send $2.00 for Guaranteed Market Information, Illustrated Book and start. Washington Mushroom Ind., Dept. 122, 2954 Admiral Way, Seattle, Washington.

$35 WEEK extra! Operating proven business and moneymaking plans. Nacci, 7731 Heyden, Detroit, Michigan.

MAKE Money at Home. Let me show you how to get $1 to $20 checks in your daily mail doing simple, spare time Writing. Experience unnecessary. Details free. Herwell, 7016 Euclid, Cleveland 3, Ohio.

EARN Money Evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle 3, Wisconsin.

NEW Patented, Hobby-horse. It walks. It rocks. Exclusive territory. Manufacturing rights. Free details. Carl Markowski, Lewiston, Idaho.

UNPAINTED Novelties. Good Profits. List Free. Novelty Products, 146 Railroad St., Tiffin, Ohio.

INEXPENSIVE Fire Extinguishers From Light bulbs now Possible. Complete Instructions Only $1.00 Postpaid. Fred A. Lewis, Box 104, Kensington Sta., Brooklyn, N. Y.

BIG Profits. Make fast-seller chenille holiday flowers, monkey trees, dolls. Literature free. Veiva, Bohemia 17, N. Y.

MIMEOGRAPHED newspaper clears $50 weekly. Copy 25c. Advertiser, Ajax, Ont.

UNPAINTED Plaques, Religious Statuettes, Book Ends, Novelties. Paint them yourself for profit. Free list. Umlauf, 239 So. Luther, Detroit, Michigan.

$250 WEEK Reported! Free book "505 Odd Successful Businesses." Work home! Expect something odd! Pacific-ES, Oceanside, California.

DEFENSE welding jobs pay. Welders needed. Train quickly. VA contract. Hobart Welding School, Box P-317, Troy, O.

YOUR ad here will be seen by 3,992,000 potential customers. Cash in on this great mail-order market today!! Closing date for May issue is March 26th. For free information and order blank write O. K. Kelly, Classified Adv. Mgr., Popular Science Monthly, Dept. M-7, 353—4th Ave., New York 10, N. Y. Also request our free booklet on "How to Make Money out of Classified Advertising."

58 FORMULAS, PLANS, ETC.

FORMULAS, trade secrets, for nearly everything. Catalog free. Creative Publishers, Winnetka 7, Illinois.

FORMULAS—All kinds. Latest products. Literature free. Kemico, Park Ridge 15, Ill.

10,000 FORMULAS and Trade Secrets. Free Literature. Stillmans, 555 Kingston Ave., Brooklyn 3, N. Y.

LABORATORY tested formulas. Lists free. Pont, Box 635-PS, Terre Haute, Ind.

MAKE artificial gold. Instructions $1.00. Western Laboratories, 1124 East Apache St., Phoenix, Arizona.

RECIPE—how to make syrup with corn cobs. Taste like Maple. $1.00. A. J. Ross, 1139 E. Taylor St., Phoenix, Arizona.

POPULAR SCIENCE OPPORTUNITIES

FREE Formula Catalog anything analyzed $20.00. Western Chemical, Salem, Ore.

WRITE For Miller's Monthly Messenger Listing Newest 1951 Money-Making Formulas. Fifty Years Supplying The Best. Miller, Manufacturing Consultant, Tampa, Florida.

59 PLASTICS

LUCITE & Plexiglas Offcuts—Minimum to 10 square inches—Clear & Colored—up to ¼" thick. (Introductory offer expires March 31). All Shipped Prepaid. 4 lb., $2.00—12 lb., $5.00. Free Price Lists. Caraday, 160 East 34 St., New York 16.

LEARN Plastics at home. Small cost—spare time. Complete experimental outfit and full instructions furnished. Details free. Plastic Projects, Box 5151-D, Detroit 35, Michigan.

PLASTIC supplies, materials, instructions for hobby or business. Send for free catalog. Tells about internal carving. Hayn Plastics, 1310 82nd Ave., Oakland, Calif.

LUMINESCENT Plastics, casting liquids, rods, sheets. Send 25c for list and samples. Storin Plastics, Box 324, Niagara Falls, New York.

LUCITE, Plexiglas. Any size sheets masked Square foot (12 x 12) cost 1/16" $1.20; ⅛", $1.40; 3/16", $1.75; ¼", $2.08. Colors add 10%. Include 10% postage. Almac Plastics, 230 Fifth Avenue, New York 1, New York.

INTERNAL Carvers ($4.00 value) $2.00 Prepaid (Introductory offer expires March 31) 1 lb. Carving Blocks ⅜" to 1" Lucite & Plexiglas, 2 Tapered Drills, 3 Small Burrs. Money back Guarantee. Free Price Lists. Caraday, 160 East 34th St., New York 16.

HI-Profits, Internally Hand Carved Plastics, Gifts—Jewelry. Free Catalogue. Pilot Plastics, 67 B. Fulton St., N. Y. C. 7.

PLASTIC Sheets, Rods, Tubes, etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

NEW liquid plastic. Clear, colors. Cast without heat. Embed flowers, insects, coins. Saw, drill, carve. Free Folder. "Liquid Magic," shows fine things you can make and sell. Write today. Castolite, Dept. C-102, Woodstock, Illinois.

PLASTICS—Wholesale, retail. Sheets, rods, tubes, casting, molding plastics. Jewelry findings. We manufacture full-color carving dyes. Catalog, instructions, 10c. 25c airmailed. Gem-O'-Lite, Box 686Z, North Hollywood, Calif.

PLASTIC letters for Signs, House Numbers, etc. Samples 25c. Plastic Exchange, Box 302, Bradenton 5, Fla.

60 CHEMICALS AND APPARATUS

NEW Idea Chemical and Apparatus Outfits for Home Experimenting. Photo-Scales, Microscopes, Chemicals, Biological and Laboratory Supplies in Small Quantities. Catalog 15c. Established 1931. John H. Winn, 124-B West 23rd Street, New York 11, N. Y.

LABORATORY Apparatus, Chemicals, Microscopes, Complete Chemistry Sets, Minerals, Uranium Ore, 10c brings catalog. Porter Chemical Company, Hagerstown 2, Maryland.

LUMINOUS Paints will glow in dark. Six colors. Fairmount Chemical Co., 136 Liberty St., New York City 6.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology, 10c. Tracey Laboratories, Evanston, Illinois.

OH Boy! New Book Of Science, Experiments, Formulas, Secret Processes, together with Catalogue of Laboratory Supplies. Only 25c. National Scientific Company, Dept. 15, 2204 W. North Avenue, Chicago 47, Illinois.

SAVE on chemicals, supplies. Catalog 10c. Laboratory Sales, Box 161, Brighton, Massachusetts.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 15c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N.Y.

URANIUM ore sample, weighing scale, catalog of chemicals, apparatus, kits. $1.00. Catalog only, 10c. Rex Laboratories, 2849-B Birchwood, Chicago 45, Illinois.

61 HELP WANTED

FOREIGN & Domestic Construction Projects. $1.00 brings Report published each month on World Wide Jobs in Canada, South America, Arabia, India, Africa, Alaska. How to apply & application forms. Jobs, P.O. Box 883-PX, Hollywood 28, Calif.

ALASKA—America's Frontier. $1.00 brings 1951 Business Directory, Large Government Map giving Up-To-Date Construction Projects, Current employment information, Homestead & Highway facts, Hunting-Fishing-Game Rules, Firms hiring & application forms. Alaska Opportunist, P.O. Box 883-S, Hollywood 28, Calif.

$5 HOUR Easy! Sell name plates for houses. Free Sample, order blanks. Write: National, 214 Summer, Boston, Mass.

FOREIGN Employment Construction Men, Building Trades, Mechanics, Helpers, Office Men. Good workers interested in Foreign Development projects, Pipe Lines, Dams, power plants, Roadways, Shipping, oil Refineries, etc. Transportation and quarters furnished; High Wages. Listings of firms actively working on projects in Arabia, Persian Gulf, Africa, Alaska, Canada, South America, Europe, etc. Send $1.00 for Foreign Construction Compendium and Application forms. Foreign Service Bureau, Dept. PS-3, (Employment), P. O. Box 295, Metuchen, N. J.

CONSTRUCTION Workers! Where is your next job going to be? Learn where the big jobs are. Jobs breaking. Jobs underway. Big job list. Latest information. Accurate. Don't delay. Send today. $1.00. Dempster's Construction Scout News, Dept. 268-DC, Bridgeport, Ill.

FOREIGN & Latin American Employment, 1951 "Foreign Service Directory" gives Up-To-Minute Facts on Military & Civilian Construction, Government Jobs, Major Oil Listings, Aviation, Transportation, Steamship Lines, Mining, Importers, Exporters, How-When-Where to apply, application forms, Hot List Firms Hiring. $1.00 post-paid. Global Reports, P.O. Box 883-S, Hollywood 28, Calif.

HONOLULU, Hawaii Employment? Latest male and female help wanted columns airmailed for $1.00. Certified Services, #3 Campbell Block, Honolulu, Hawaii.

YOUR ad here will be seen by 3,992,000 potential customers. Cash in on this great mail-order market today!! Closing date for May issue is March 26th. For free information and order blank write O. K. Kelly, Classified Adv. Mgr., Popular Science Monthly, Dept. M-8, 353—4th Ave., New York 10, N. Y. Also request our free booklet on "How to Make Money out of Classified Advertising."

62 AGENTS WANTED

STRANGE "Dry" Window Cleaner. Sells like wild. Replaces messy rags, liquids. Simply glide over glass. Samples sent on trial. Kristee 126, Akron, Ohio.

$5 HOUR Easy! Sell name plates for houses. Free Sample, order blanks. Write: National, 214 Summer, Boston, Mass.

COMMERCIAL Deep Frying Course. Mock Chicken Legs, Potatoes, New and proven methods. Learn about this money-making field. $2.50. PP. Concession, Toledo 13, Ohio.

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 18, Chicago 4, Illinois.

DRESSES 18c; Coats $1.00; Blouses 35c; Free Catalog; Crown, 164-PB, Monroe St., New York 2.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 437 N. Clark, Chicago.

GOLD lacquered Window Sign Letters. Large Sizes Penny Each. New foils. Absolutely Beautiful. Free Samples. Atlas, 544 W. 79th, Chicago 20.

GAMES, Punchboards, 40% commission. Webb Distributing, 4966 West Chicago Avenue, Chicago 51, Illinois.

FAST profits—No investment. Send for big, free catalog. Plastic aprons, tablecloths, etc. 150 sure-fire items. We guarantee sales. Write The Halliday Co., Dept. P, 15-19 Pennington Ave., Passaic, N. J.

NYLON, Poplin, Rayon Uniforms, white and colors. Immediate Delivery. Immediate Profits. Sell to Doctors, Dentists, Nurses, Waitresses, Beauticians, Housewives. Free Sales Kit. Superior Fabrics, Dept. A-3, 3936 Market St., Phila. 4, Pa.

START Your Own Business on credit. Always your own boss. 1550 Dealers sold $5,000 to $28,000 in 1949; their average $6,834. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary to start. Wonderful opportunity to own pleasant profitable business backed by world-wide industry. Write Rawleigh's, Dept. C-U-PSC, Freeport, Ill.

IS $210 a week worth a penny postcard to you? Then rush card with name and address for special Free Trial Plan that sells amazing new Automatic Refrigerator Defroster "like hot cakes!" Write to Mr. Lewis, D-Frost-O-Matic Corp., Dept. PSC-3, 6 N. Michigan, Chicago 2, Ill.

BE A Money Maker . . . Use your home as magazine headquarters. Liberal commissions. No experience—No capital needed. Everything furnished. Write for Free Catalog. McGregor Magazine Agency, Dept. 510A, Mount Morris, Ill.

PHOTO-Salesmen-Agents. Sell beautiful hand colored plastic enlargements and sensational new photo compacts, rings, bracelets, lockets, etc. Collect deposit, we deliver. Profitable sideline. Send card, for Free sample kit. Novel Portrait Co., 3343-A North Ave., Chicago, Ill.

FREE SAMPLES. Big profits showing amazing Glow-in-the-Dark specialties. House numbers, pictures, plastic novelties, ashtrays, keyholders, religious and nursery objects, etc. Madison Plastics, 303 Fourth Ave., New York 10, N. Y.

ABSOLUTELY Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 7006, Cincinnati 25, Ohio.

NEW "Sponge" Wall Cleaner. Erases dirt like magic. Wallpaper, painted walls, ceilings. Saves redecorating. Lightning seller. Samples sent on trial. Kristee 125, Akron, Ohio.

AT Last! Something New and Sensational in Everyday Cards. 21 for $1. Make Extra Money Fast! Show Satin, Velour, Metallic Cards. Get orders easy. Big line $1 Assortments, Scented Stationery, Personal Matches, Kiddie Books, Imprints Free. Two $1 boxes On Approval. Puro Co., 2801 Locust, Dept. 141-C, St. Louis 3, Mo.

MAKE Money Calling On Friends! Show nationally advertised Greeting Card Assortments—new All-Occasion Assortment and laugh-packed Barrel-of-Fun Assortment. Sells for $1.00—up to 50c profit for you! Also Personal Notes, Gift Wrappings, Stationery, Gift Items, others! Get Two assortments on approval. Write Wallace Brown, 225 Fifth Ave., Dept. T-4, New York 10.

AMAZING discovery. Master Glaze, puts brilliant glass-like surface on cars. Free Sample, information. Big commissions. Master Glaze, Dept. 710, 7720 Harwood, Milwaukee, Wisc.

ADVERTISING book matches—Cash in on big demand—sell Union Label matches. Cuts for all businesses and political parties—Free powerhouse selling kit—low prices—protection guaranteed on repeat orders—Cash commissions. Superior Match Co., Dept. P-351, 7530 Greenwood, Chicago.

FREE! Let me send you food and household products to test in your home. Tell your friends, make money. Rush name. Zanol, Dept. 9091-C Richmond St., Cincinnati 3, Ohio.

NEED Extra Cash? Take orders for personal initialed belts and buckles, cap badges, tie holders, etc. Choice of 3000 emblems. Free sales kit. Hook-Fast, Box M-101, Providence, R. I.

EXTRA cash selling shoes direct in spare time. Advance commissions. Bonus. No investment. Experience unnecessary. Free outfit. Samples. Paragon Shoes, 738 Columbus, Boston, Mass.

HOTTEST Money-Maker Out! New idea ironing pad pays you up to 100% profit. Saves housewives time, labor, money. Minute demonstration. Fully guaranteed. Plastic Clothes Line, other sensational sellers. Free Sample Offer. Sheldon, 1223 South 23rd, Dept. 550, Milwaukee, Wis.

POPULAR SCIENCE OPPORTUNITIES

POSITIVELY New. Over 100% Profit. Two Sided Reversible Neckties. Free Details. Farrell Company, Dept. C-20, 1377 Van Zandt, Cincinnati 31, Ohio.

BUY wholesale. 25,000 items. Catalogue 25c. Matthews, 1472 Broadway, N. Y. C.

DO you need money? $40.00 is yours for selling only 50 boxes of our 200 Greeting Card line. And this can be done in a single day. Free samples. Other leading boxes on approval. Many surprise items. Experience unnecessary. Free samples Personalized Stationery, Napkins. Write today. It costs nothing to try. Cheerful Card Co., 178 White Plains, N. Y.

WONDERFUL Invention brings new relief to foot sufferers! Sell two pairs a day, make up to $5.00 daily in spare time! Free Demonstrator Outfit for serious men, write to Owen Mason, "Velvet-eez," Chippewa Falls, Wisconsin.

POWER Mower—$59.50. Sensation Buy direct. Extra discount. Rotacut, RM-2003, Excelsior Springs, Missouri.

FREE sample nylon stocking of world's only nationally advertised hosiery line actually guaranteed against runs, snags or excessive wear, regardless of cause! It's amazing but true. Every weight from sheerest 15 denier to heavy 70 denier—all gauges to luxury 60 gauge. Amazingly low prices, starting at $1.08 prepaid for sheerest 15 denier 51 gauge. Not sold in stores. Good Housekeeping Guarantee Seal. Also complete line men's hosiery guaranteed one full year or replaced free. Full variety lingerie in crepe, satin and nylon, featuring all nylon slip at $2.95, satin slip at $1.59, etc. Housecoats and robes. Kendex sales people will earn one million dollars this year. Get your share. No money or experience needed. Pay nothing now or later. Just show free outfits. Write orders. We deliver and collect. Advance cash plus huge bonus. Earn money spare or full time. Become manager—appoint others to sell for you—earn steady income on their sales. Man or woman—young or old, you can earn more money than you ever thought possible. Everything you need is furnished free and prepaid, including nylon stocking, samples of materials, sales books, 36-page salesmanual, color cards, etc. Simply write your name and address on postcard and mail to Kendex Corporation, Babylon 34, N. Y.

HIDE-A-Key ends lockouts! Everybody buys! $1.00. Sample 50c. Merit, 6560 Sheridan, Chicago.

SELL Big Money-Maker to Men and Women. Easy handwork makes fast-selling useful articles. Sample free. Sunmade Company, Brockton 64, Mass.

JEWELRY For Salesmen Distributors Direct Factory. Catalog Free. Pickcraft (c 19) Bank St., Attleboro, Mass.

SELL Du Pont Nylon Uniforms. Complete line famous exclusive Hoover Styled nylon uniforms for beauty shops, nurses, doctors, waitresses, others. Best quality, splendid values. Exceptional income. Real future. Equipment free. Write fully. Hoover, Dept. M-101, New York 11, N. Y.

WHERE To Buy 800,000 articles direct from manufacturers. Including hundreds of scarce items. Save by buying direct. Free Literature. Glass Pub. Co., Ellwood City, Pennsylvania.

SELL New Automatic Floor Waxer. Trigger on Handle. Hands never touch Floors or Wax. Retails $2.95. Profit 125%. Write Smith, Inc., Greenfield 35, Mass.

MEXICAN feather pictures. Sell on sight; 200% profit! Free details; sample 10c stamps. Sylvia-SJ, Apartado 9036, Mexico City.

BUY thousands of nationally advertised products direct from manufacturers and distributors. Write for "Buy Direct and Save." Service Publishing, 1420-B Investment Bldg., Pittsburgh 22, Pa.

NYLONS Direct from Mill. Free sample stocking. "Guaranteed against runs." New Process 100% DuPont Nylon gives great strength and elasticity. Proportioned to Fit, width and length to your size. That's why not all "51-15" are the same. Just show the stocking, you get orders. We deliver and collect. Advance Cash plus 40% Bonus. All year you sell our Nylon hosiery, slips, gowns, neckties. Become Crew Manager, earn more money. Erglin Hosiery Mills, 992 Columbus Ave., N. Y. C.

MAKE Wedding Profits. Sell invitations, napkins, matches. Samples free. Dunbar's, Middlebush 5, N. J.

NYLON'S First Quality, Low Mill Prices. Miracle Manufacturers, Conshohocken, Pa.

PAINTS—All kinds, 65c gallon up. Private label. Certified Products, Louisville, Ky.

SELL $2. Fire Extinguishers. Locally, mailorder. Lorrac Products, Albany 1, N.Y.

SELL Beautiful Wall Plaques. Pheasants, butterflies, fruit, flowers, cardinal. Sample assortment $3.75. Write for 16-page catalog of household items. Sunshine Sales, Dept. PC-1, Loudonville, Ohio.

WOULD You pay 3%—first $350 made? Book "505 Odd Successful Businesses" free! Expect something odd! Pacific-ES, Oceanside, Calif.

LEOPARD Blankets, Simulated Diamonds. Tyrcha Wholesale, 4532 N. Meade Ave., Chicago 30, Ill.

SELL!! Balloons, Combs. Specialty Merchandise. Carleton House Distributors, Texas City, Texas.

YOUR ad here will be seen by 3,992,000 potential customers. Cash in on this great mail-order market today!! Closing date for May issue is March 26th. For free information and order blank write O. K. Kelly, Classified Adv. Mgr., Popular Science Monthly, Dept. M-9, 353—4th Ave., New York 10, N. Y. Also request our free booklet on "How to Make Money out of Classified Advertising."

63 HIGHGRADE SALESMEN

$5 HOUR Easy! Sell name plates for houses. Free Sample, order blanks. Write. National, 214 Summer, Boston, Mass.

BIG Money Taking Orders: shirts, ties, sox, pants, jackets, sweaters, shoes, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AV Lincoln, Chicago.

M/KE Money with famous, easy-selling Bostonian shirts—spare time, full time, sideline. Fabrics, outfit Free. Bostonian, 89 Bickford, Dept. B-11, Boston 30, Mass.

BEST Source for Nylons. Rich Supply, 215 West 98, New York 25.

EARN spare time extra money. Show amazing cushion comfort shoes. To $3.25 commission per pair, plus big Cash Bonus. Experience unnecessary. Write for Free Catalog, full information. Tanners Shoes, 779, Boston, Mass.

$2600 NEXT 9 weeks—season starting. Sell Calendars, Specialties, Matches. Prospects everywhere. Advanced Commissions. Experience unnecessary. Samples Free. Continental Calendar, 542-B South Dearborn, Chicago.

WRITE 3 Words—Collect $7.65 on 10-second Demonstration to merchants—write on glass with Amazing Magic Crayon—Presto!—3-color advertising message takes fire—glows like brilliant Neon. Three sales daily bring $22.95 profit. Rush postcard for details.—Complete Sales Kit, Free! Maxilume Co., 125 W. Hubbard, Dept. CL-93, Chicago 10, Illinois.

FREE Sample & Information: Sensational new fishermen's article. Nelson Company, Dept. G, St. Paul 2, Minnesota.

WANT to make real money? You can positively make $50.00 a day and up selling a brand new item going to every type of food and beverage store, factories, Laboratories, Hospitals, etc. First time advertised. Write for Free Details today. Johnson-Hartman, 53 West Jackson Blvd., Dept. PS-3, Chicago 4, Illinois.

MAN to earn $85 week and up. Long needed invention. Advertised in Saturday Evening Post. Full or part time. Exclusive Territory. No investment. Free sample outfit. Write Red Comet, Inc., Dept. 888, Littleton, Colorado.

AD Matches! Sell Amazing Designs—20, 30, 40 and 240-light book matches. Big spot cash commissions; every business a prospect. Low prices for high quality. Repeats. Start without experience; men, women; full, part time. Buy Nothing! Sales kit furnished. Match Corp., Dept. PS-15, Chicago 32, Illinois.

EARN Big Money Fast! Sell finest-quality advertising work uniforms to garages, factories, filling stations, etc. Free selling kit. Topps, Dept. 543, Rochester, Indiana.

SALESMEN—The Name Eberhard Faber is a guarantee of quality. We imprint and distribute advertising pencils of Eberhard Faber make. Link up your name with Quality Pencils. Ballard Pencil Co., Glenwood, New Jersey.

67 EDUCATIONAL AND INSTRUCTION

MULTIPLY Your Income! Finance, Business, Stock Market, Investment, Economics Course $1.00. Refundable. Titan Company, 45 Clinton St., Newark 2, N. J.

USED Correspondence Courses and Books sold and rented. Money back guarantee. Catalog free. (Courses Bought). Lee Mountain, Pisgah, Alabama.

MEDICAL Laboratory Technicians in great demand. We train you in your own home. Catalogue free. Imperial Technical Institute. Box 973-B, Austin, Texas.

SHORT writing in week. Lesson ten cents. Elliott, 4436 Carrollton, New Orleans, La.

MAKE Up To $35-$45 Week as a Trained Practical Nurse! Learn quickly at home. Booklet free. Chicago School of Nursing, Dept. M-3, Chicago.

PIANO Tuning Pays. Learn this profitable profession at home. Our Tonometer and mechanical aids make learning easy. No knowledge music necessary. Diploma granted. Largest and oldest school—51st year. G. I. Approved. Write for booklet. Niles Bryant School, 77 Bryant Bldg., Washington 16, D. C.

ACHIEVE business and financial success in your own Collection-Credit Agency business. Home or office. Quickly learned. Free folder. Write Cole & Associates, Syracuse 2, New York.

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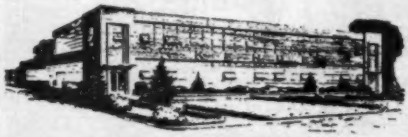

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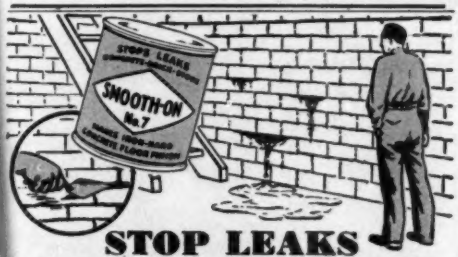

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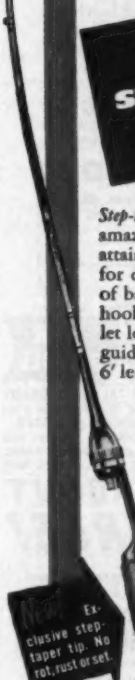

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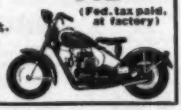

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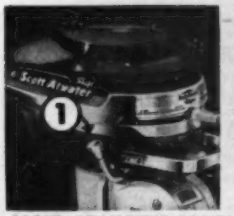

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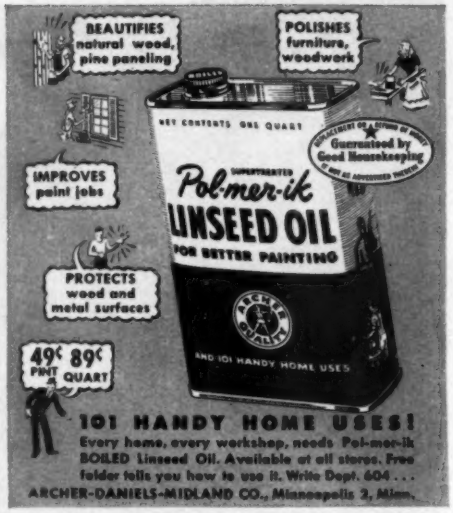

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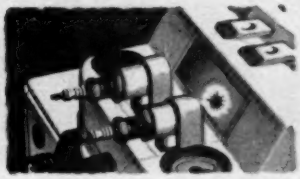

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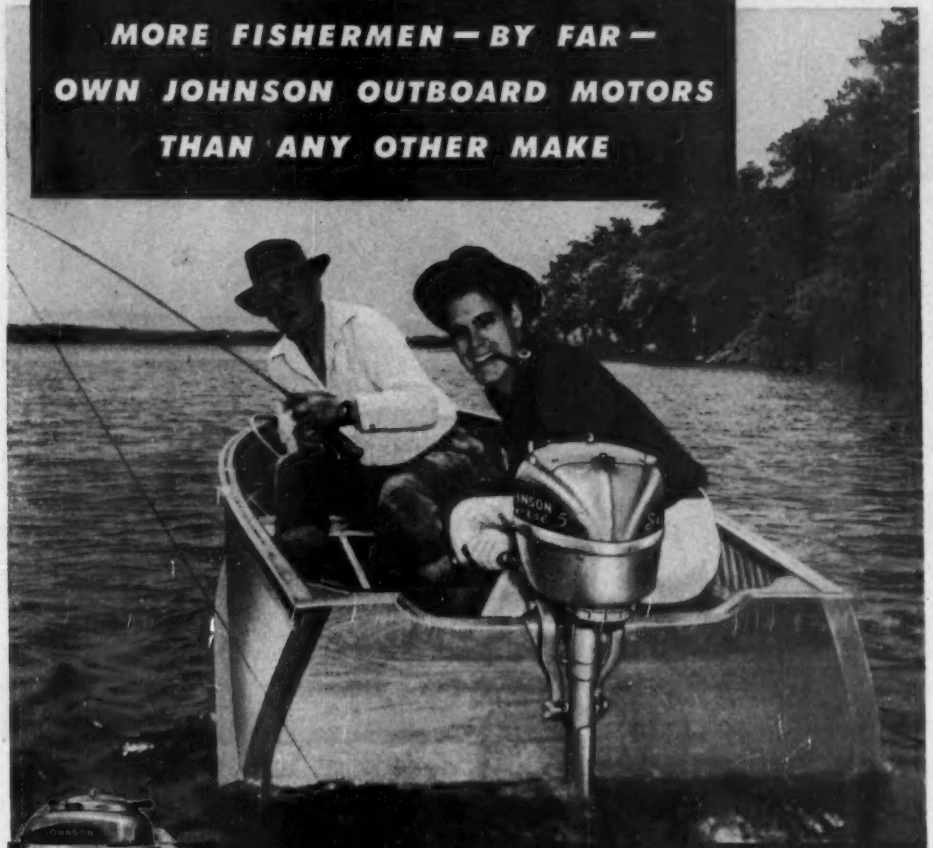

Yes, by actual count among fishermen in a nation-wide survey (subscribers to America's leading outdoor magazines) Johnson leads any other make of outboard motor by 76%.

Another survey, among the nation's automotive engineers from coast to coast, also shows preference for Johnson. In this case Johnson leads by 82%!

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FREE HANDY CHART. Describes the four versatile Sea-Horses for 1951. Your copy sent free. WRITE today!

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4 GREAT SEA-HORSES FOR 1951

SEA-HORSE 25: 25 H. P. *Only 85 lbs.!* With Gear Shift, Synchro Twist-Grip Speed Control, six-gallon Mile-Master Fuel Tank . . . . . Only $390.00*

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Paul Hesse photo

Wheel trim rings, and white sidewall tires if available, at extra cost

Here's your thrifty one for '51
The New Studebaker Champion!

Top value of the top 4

in the lowest price field!

The Studebaker Champion is one of the 4
lowest price largest selling cars!

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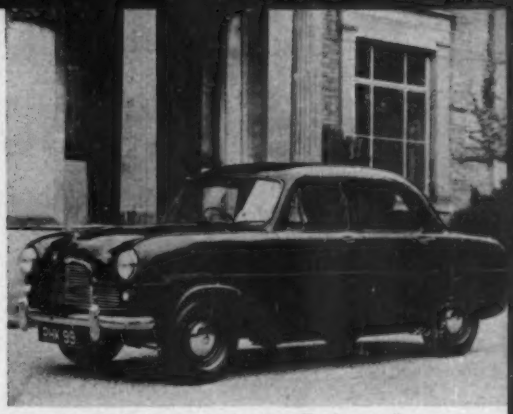
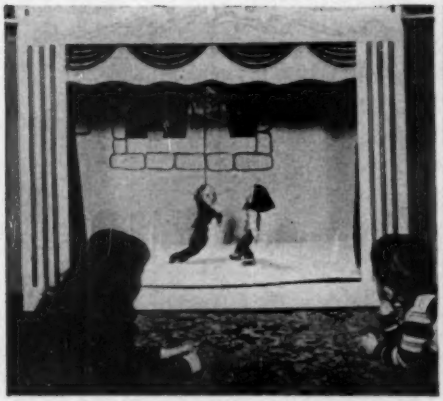
SEE THE EIGHT AMERICA RATES AS GREAT...THE 1951 STUDEBAKER COMMANDER V-8

©1951, The Studebaker Corporation, South Bend 27, Indiana, U. S. A.

Popular Science *Highlights* this Month



British Ford Adds Two Cylinders: Zephyr is first six-cylinder Ford built in Britain. Though small, it has U. S. style and performance. **Page 150**



Home Theater Challenges TV: Here's how to build a fold-up theater that's convertible for use with puppets or marionettes. **Page 170**

How to Kill in Korea: Russian-made small arms, crude but plentiful, defy UN big weapons and overwhelming air power. **Page 107**

Chairs Pop Out of TV Set: House your table-model television set in this cabinet and your pop-in guests will be seated. **Page 202**

Caveat Emptor: "Buyer beware" is the Roman warning, and here is why you should heed it in buying a secondhand station wagon. **Page 197**

This is that Belgian paving block that I drove the special Special over. I don't know what I'm doing with that left hand. Looks as though I'm trying to thumb a ride, doesn't it?

We had plenty of mud for some high-speed turns. This was an especially fast, short-radius turn, and you can see for yourself what the roll was. Look at Buick's restyled front end.

I was curious about the exact diameter of the

By Wilbur Shaw

PS PHOTOS BY HUBERT LUCKETT

REPORT FROM THE

DRIVER'S SEAT...

BUICK has a new model for 1951, and I've driven it.

It's almost three inches narrower than the smallest job in their line for last year. Yet the amount of space sacrificed in seat width could be put in a pocket. There's less dead air between the sheet metal and the seats.

The car's more powerful. It has a new rear-axle ratio. It has more snap. It's a little taller, a little longer. And it costs less than any other car in the Buick stable.

That's a quick run-through on what I'd call Buick's "special" Special. For that's exactly what Buick has done to produce a new model—they've revised their famous Special (PS, Sept. '49, p. 162) to create another series of cars. In the place of the three they had before—the Special, Super, and Roadmaster—they now have four. The Special has become the Special Custom, and the new series fell heir to the old name of Special.

That's just so much mumbo-jumbo without a description of the special Special. So let's take off and see how she performs on the road.

I put the new model, equipped with optional Dynaflow drive, over the jumps at the sprawling General Motors Proving Ground.

Shaw Tries Out the New Little Buick

turning circle of the little Special, so I measured it. For the result, see the box on page 104.

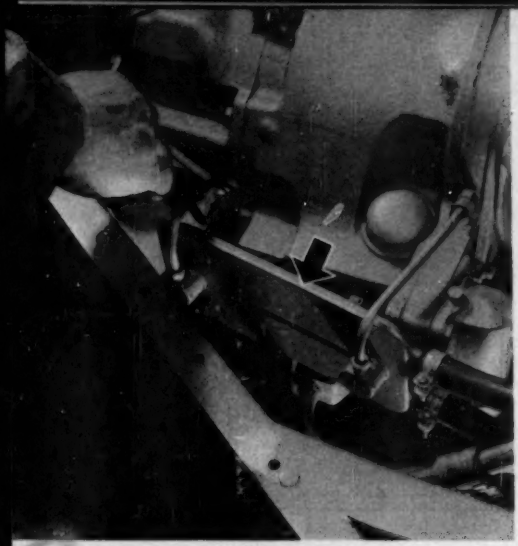
I described the place when I reported to you on the 1951 Pontiac in the January POPULAR SCIENCE. I didn't tell you that the proving ground has, among other things, its own weather forecasting station and some gimmicks to test cars' ignition systems for their effect on television reception.

Here's the start of my playback as I climbed into the Special at the Buick garage.

They've improved the heater controls. It took two men and a boy to work the old ones. You never knew just how much heat you were turning on. There's a two-stage blower, too. That's an improvement.

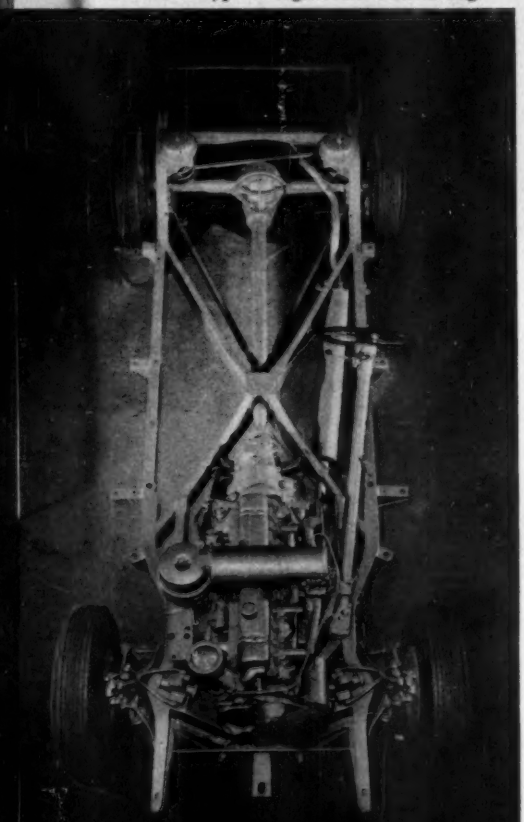
I like having the engine starter button under the accelerator pedal, like this . . . if you've got to have a switch and *a starter button . . . I wonder why more manufac-*

This is what comes of failing to roll the window clear up when you drive through mud. Incidentally, did you know that most of the "dirt" on race drivers' faces is tire rubber?



I've been asked how the transmission oil in Buick's Dynaflow unit is kept cool. The arrow points to the heat exchanger, connected to the regular radiator, that cools it.

This is the Buick chassis I drove. The rear coil springs are centered on the axle instead of just behind it as heretofore. Roadmaster models have a new type of segmented brake lining.



turers don't adopt the key-starter idea . .

Now I eased in on the accelerator, slowly, to see how much she revved up before the car started moving. This is a matter of controversy, this over-run by the engine before you develop enough torque with Dynaflow to move the rear wheels. The Buick people insist that the engine *doesn't* over-run if it's driven properly—that you just imagine it does, from the noise level in the absence of any transmission noise.

A Pat on the Back for Dynaflow

That engine speed does seem excessive to me . . . I wouldn't be pulling that many revs in conventional low with a clutch . . . Yet anyone who argues that a torque converter . . . Buick pioneered this type of transmission in passenger cars. Anyone who argues that a torque converter isn't the world's smoothest way of transmitting power . . . is just plain talking through his hat.

Another thing . . . I want to be fair about this transmission . . . I'm convinced that torque converters cost gas because of slippage at cruise and low torque at low engine speeds at take-off . . . but it would take an expert to get the acceleration with a one-two-three shift that you get out of this Dynaflow . . . it practically glues you to the seat.

The car was eerily quiet, like all Buicks. The hydraulic valve lifters, standard with Dynaflow, help keep the noise level down.

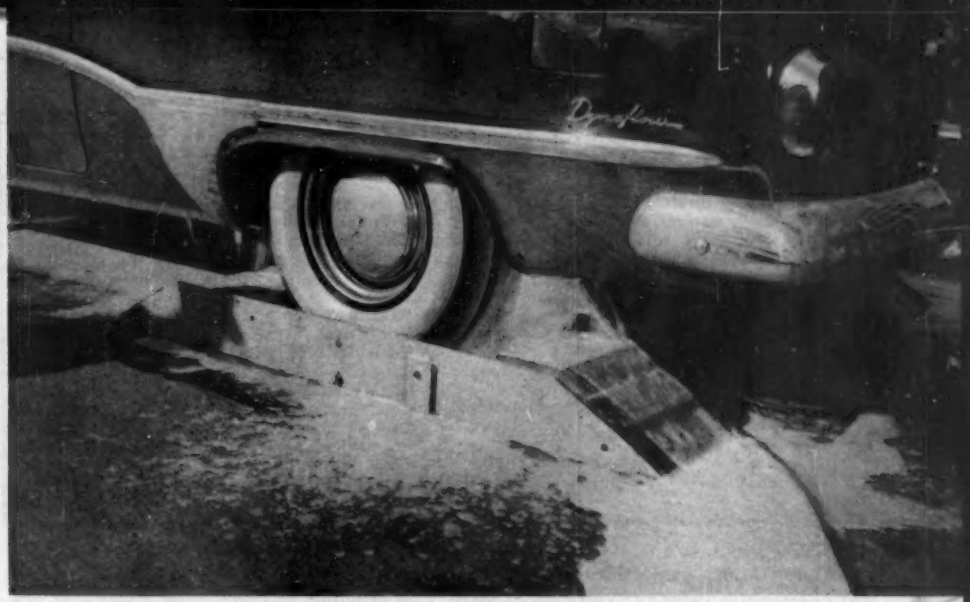
One of the first things I wanted to do with the Special was to find out how it would act on a hard hill. So I tackled that 27 percent grade I mentioned in January. I had three passengers in the car.

Tackling the 27-Percent Grade

Just to make it tough . . . I'll use a standing start. The selector lever's in Drive range. She starts from full stop slowly . . . it takes a second or two for the rate of acceleration to pick up . . . I'm rolling, gaining speed . . . now the speed has levelled off . . . 12 miles an hour, over the top.

I'd driven a Hydra-Matic up this same grade, and it had done better, also with four people in the car. Yet it was hard to find fault with an automobile equipped with a torque converter that would take a grade like that with a good load without forcing the driver to shift to Low range.

For 1951 Buick has made a pronounced change in the valve mechanism governing the manual shift from Low to Drive range. Low, of course, is never used unless the



Here's a trick. This wheel is spinning in a trough of soap suds. To get out, the car must be rocked. The test shows how fast the automatic drive shifts between Drive and Reverse.

going gets tough. The change smooths out the transition from one range to the other. I couldn't detect it at all in the car's behavior.

I tried some high-speed turns on a mud road and then some on pavement that would give me enough footing to avoid a skid.

She corners well . . . remarkably well . . . without excessive roll. As a matter of fact, I'd say the roll was less than normal in a car of this size, weight, and silhouette . . . there's practically no effort to handling the Special . . . it recovers nicely when a sudden turn of the wheel displaces her . . .

Some customers might find the tire noise objectionable . . . I don't . . . I like soft tires for easy riding, and they give you a bigger footprint . . . that means more safety when you have to stand on the brakes.

I keep easing back on the accelerator as I gain speed from a standing start, to unload the engine . . . I guess I expect a shift . . . yes, that's it . . . as in some other types of automatic drives. A lot of people who buy Dynaflow and Powerglide . . . that's Chevrolet's name for it . . . are going to have to relearn their driving habits . . . completely . . . and they're going to be delightfully surprised.

The ride's soft . . . maybe too soft . . .

I found out about that when I hit the Belgian blocks. This is a rough stretch, with turns. I still had three passengers with me.

The rear springs just hit the bumper blocks. There! They hit again. Any king-

The brake lever is far enough to the left so that a person can easily use his left foot on it. That foot pedal at the other side of the brake is the emergency I mention in my text.

The photographer caught me here on that 27-percent grade—without passengers this time. Several changes have been made in the Dynaflow for '51, mostly in the control valves.

Facts on '51 Buick Series-40 Special

Make and model: Buick four-door series 40 Special sedan.

Engine: 8-cyl. valve-in-head; 128 hp. at 3,600 r.p.m.; car weight per hp., 28.44 lb.; bore and stroke, 3 3/16" by 4⅛"; compression ratio, 7.2:1; piston displacement, 263 cu. in.

Engine piston travel: (in feet per car mile at 20 m.p.h.)—3,453.

Crankshaft bearing surface: 53.58 sq. in.

Torque: 219 lb.-ft. at 1,200 r.p.m.

Transmission: Dynaflow torque converter.

Rear-axle ratio: 3.6:1.

Steering ratio: 19.8:1.

Diameter of turning circle: 41' 6".

Effective brake-lining area: 161.5 sq. in.

Springs: coil, front and rear.

Weight and outside dimensions: 3,848 lb.; including 62 lb. of factory-installed equipment; height with 5 passengers, 63.4"; over-all length with bumpers and guards, 204"; width, 76.7"; wheelbase, 121½"; front overhang, 33.5"; rear, 49.8"; tread, front, 59.1"; rear, 59".

Inside dimensions: seat-cushion width, front 63.1"; rear 63.4"; legroom, front 43.1"; rear 41.2"; headroom, front 35.5"; rear 35"; seat height, front 13.5"; rear 12.3"; vertical distance, steering wheel to seat cushion, with seat in mid-position, 5"; front-seat adjustment, horizontal 4"; vertical .25".

Tire size: 7.60 by 15.

size bump on this road will cause that. This car obviously is sprung to carry up to three people . . . Beyond that, you have to take it easy on hard bumps. Car manufacturers are always between the hammer and the anvil on springing . . . If the springs are just right on smooth roads with the seats full, they're too soft on bumps. Nash has had the same trouble . . .

There's compensation, though . . . this job keeps its feet firmly on the ground despite the bumps . . . I don't get any skitterish feeling on the turns . . .

Hitting It Up on the Loop

Naturally, I had to try the Special in the GM high-speed lane on what they call the Loop. Each lane has its own speed. The Loop has an electric-eye warning system for cars crossing the track. It tells them of the approach of any of the big trucks on test. After all, it takes time to stop a truck that's really rolling.

We're making knots now . . . nothing wrong in this department . . . the car handles hands-off in the turns . . . there's 85 on the clock . . . now there's 90 . . . the speed creeps up on you without your knowing it . . . all of a sudden you're doing . . . there's 95 now, and I imagine it's pretty close to right . . . now it's just short of 100 . . .

The brakes are okay . . . not too soft, but not grabby. And I've always liked this foot-operated parking brake, by the way. It's perfect for the ladies . . .

This new kind of glass in the windshield bothers me . . .

Buick for '51 is introducing an optional all-around glare-cutting glass, with particular attention to that in the windshield [PS, Jan. '51, p. 100]. The glass was developed by one of the leading manufacturers specifically at Buick's request. It has a bluish-green tint that filters out almost half of the sun's heat rays. In the windshield there's a deeper band of color at the top. This gradually fades into the tint of the rest of the glass.

It did bother me. I kept feeling as though I was about to drive through a railroad underpass. I'm not ready yet to pass on the virtues of Buick's E-Z-Eye windshield, but I'd like to remark now that any time you cut down glare, you're cutting down light intensity. That cuts visibility, especially at night.

I drove the Special back to the garage, and just for luck took a whirl in the '51 Roadmaster. Like the Special, it has an almost unbelievably low noise level. The Roadmaster felt Cadillacky and, of course, had a lot more steam with 152 horsepower.

In sum, I'd say that Buick fans—and I know hordes of them—are going to go off their noggins about this automobile. The special Special is a valuable addition to the company's line of cars. END

This Month's Shaw-ism

There is no more excuse for abusing a car than there is for whipping a dog.

Kilbourn Shaw

New Ideas from the Inventors

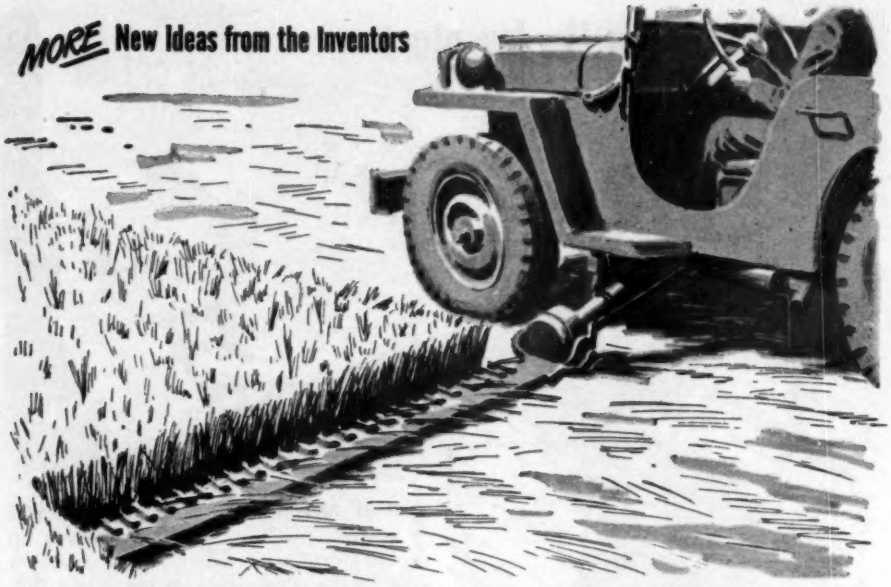
2 Slot Machine to Sell Cones. This vending machine, designed to serve up an ice-cream cone, offers you a choice of four flavors when a coin is put in the slot. A built-in refrigerator keeps the ice-cream fills hard until they drop automatically into cones as needed.

1 Fire Escape to Unfold. Collapsible ladders, mounted into windows (inset), unfold when needed to form this fire escape. A person fleeing from a fire unfolds the ladder at his window, climbs down to the level of the window below, unfolds the ladder there, and repeats the process until he reaches the street. Folded, each ladder forms an ornamental grille.

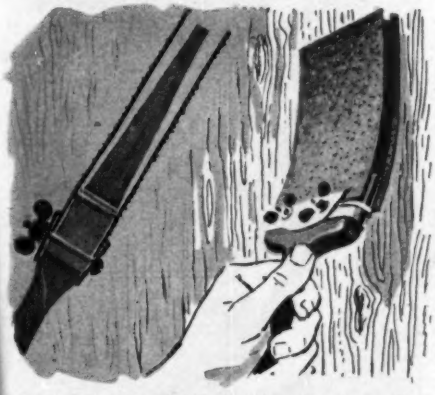
3 Sickle to Use Razor Blades. Anyone who has old razor blades and some stubble grass to trim could put this trimmer to good use. Its cutting edge is renewable—it consists of four double-edged razor blades mounted in a line on a thin metal slide. This slips between, and is held by, two spring jaws of a holder attached to an offset wooden handle.

Turn the page, please, for three more new ideas.

MORE New Ideas from the Inventors



4 Mower to Attach to a Car. Designed so it can be readily attached to a farm automobile, particularly a Jeep, this mower is operated by the vehicle's engine. Power is obtained through a take-off that is permanently hooked into the car transmission but does not interfere with the normal operation of the car when the mower is not in use. A coupler on the take-off allows easy attachment or removal.



5 Sander Used Like a Brush. A sanding tool that can be wielded like a paintbrush is said to be less tiring to use than the conventional sanding block. The gadget consists of a handle, a flexible-rubber center section, and a clamping device for attaching a sheet of sandpaper to each face of the center section.

6 Ring to Double As Lighter. Pushing a latch on the side of this ring causes the hinged setting to spring open, spinning a wheel against flint to light a wick. A tripper built into the band also allows the lighter to be operated by pressing the inner portion of the ring with the thumb of the same hand.

Patents on these inventions have been granted to: 1. C. Steele, Mooresville, N. C.; 2. H. Martin, Detroit; 3. C. Hubner, Butler, N.J.; 4. C. Wilson, Petersburg, Va.; 5. C. Rogers, Port Sandfield, Ont., Canada; 6. E. Conway, N.Y., N.Y., and V. Amendolara, Brooklyn, N.Y.

Red soldiers on parade carry the Shpaghin '41 sub-machine gun.

How Good Are Russian Guns?

The samples captured in Korea show the calculated crudity that is the real secret of Red armament and logistics.

By Perry Githens

WHEN you see the Russian equipment captured in Korea, it seems to confirm a dangerous impression shared by too many people in this country.

This is the happy and hopeful thought that the Russians are really all thumbs when it comes to machinery. Clumsy fellows who don't know a Stillson from a micrometer, and care less. Peasants in uniform, armed with gas-pipe guns, who would certainly be no match for a squirrel hunter or a rifleman trained to call his shots at a thousand yards.

It is true that many of the Russian-made weapons I saw and handled at Aberdeen Proving Ground look, at first glance, like practice work in a school for lady welders. It is also true that they can kill you very dead at the effective ranges for weapons of their type.

How good are Russian guns? Just exactly good enough and no more. From pistols to machine guns, they are deliberately made to do a job—without wasting an ounce of metal or a man-hour beyond that point. Good, solid, well made in the parts that have to be well made or they won't work. And just barely good enough in everything else.

A Yankee gunsmith might choke on his tobacco at seeing the workmanship; but he would have to grunt in appreciation of design fitted to manufacture and use.

For Russian weapons are a literal reflection of the harsh Asiatic philosophy that life is cheap. Where men are expendable, so are guns. And if guns are to be lost

The Editor, shown above with a Shpaghin, undertook this assignment himself because of his special interest in and experience with firearms. He has fired and stripped down all major types and calibers of small arms, and as an accredited correspondent since 1942, he has observed the fire of non-atomic weapons from pistols to 16-inch naval rifles. All weapon photographs were made by PS photographer W. W. Morris at U. S. Army Ordnance Aberdeen Proving Ground, Md.

in the grinding of war we politely call "attrition," it is better to lose cheap guns.

Take the Tokarev 1930 pistol as a small example of Russian realism. Although firing the smaller 7.62-mm. cartridge (.30 caliber), it closely resembles our standard side arm, the Colt .45 caliber, Model 1911. The resemblance is no accident. But the Tokarev actually is closer to earlier Colt pistols (Models 1900 and later, on the Browning patent). These were rejected for military use because they did not incorporate adequate safety devices, so Colt added a thumb-operated lock, and a grip-safety that must be squeezed before the pistol will fire. The Tokarev has only a half-cock on the rounded hammer.

Although sacrificing safety (for the man carrying it) the Tokarev has achieved somewhat more simplicity. The hammer mechanism comes out in one piece; the grips come off with the flick of a clasp. And the whole thing is well made.

The Russians don't cheat on the basic stuff. Take their bolt-action rifle corresponding to our Springfield: the Moisin-Nagant Model 1891. At Aberdeen I saw three of them only a knowing eye could tell apart.

One of these rifles was made in Czarist Russia. Another was made in U.S.A. by Remington—also for the Czar, before we got into World War I. The third is pure Soviet.

But while they were made many years and miles apart, they might have come out of the same machine tools. This particular Russian Remington, incidentally, has been quite a traveler. It was made in Connecticut, shipped to Russia, captured in Korea, and sent to Maryland—almost all around the world.

These Moisin-Nagants have been the mainstay of Red infantrymen for many a year and war. But don't get the idea this was because the Russians had nothing better.

We are justly proud of our Garand, one of the two gas-operated military rifles to be used in any quantity in World War II. The other one was the Tokarev, Models 1938-40. So the Russians were a little ahead of us.

Like the Garand, the Tokarev is gas-operated. Those who have fired both claim the Tokarev is at least as good as the Garand—maybe better. Certainly the action is visibly simpler in function and manufacture. It boasts a muzzle brake*, and carries ten cartridges in the magazine to the Garand's eight. It feels lighter, and the use of stampings and pressings makes it much cheaper.

No Tokarevs had turned up in Korea by year's end, and there is argument about their scarcity in World War II. Some think the Russians found them too difficult to make quickly in quantity; others that they were dropped because of variability in ammunition or that they called for a greater invest-

*Although the Cutts Compensator, original device for venting muzzle blast, was developed in U.S., we were the last to apply the principle widely in small arms and big guns.

ment in manufacture and training than simpler weapons.

But an interesting possibility is that the Tokarev has been developed further into a light machine-rifle and deliberately kept under wraps. It is known to have appeared in its original form as a full-automatic. And, given lighter construction and longer detachable magazines, it could be a formidable weapon.

One of the best of the Russian small arms is the Degtyarev Model 1928 light machine gun, opposite number of our Browning Automatic Rifle—the solid, reliable old BAR beloved of U. S. Infantry and Marines alike. Again, the Russian job is light, simple to field-strip or change barrels—and costs a fraction of the dollars and man-hours that go into a BAR.

The Degtyarev is gas-operated, handles the standard 7.62-mm. Russian rifle cartridge in flat, circular pans holding 47 rounds, side by side, points to center. You can identify the Degtyarev in photos from Korea by these round magazines. I handled only the type issued to ground troops, but Roger Marsh sketches several varieties in his excellent "Weapons I."* This "Pictorial Survey of Russian Small Arms" is brief but meaty, and more complete than any other publicly available material. Marsh calls the Degtyarev "quite possibly the best light machine gun of the present time."

Heavier Russian weapons reveal the same cold-blooded approach to the problem. They are simple, even at the price of safety. They are precisely machined wherever precision pays off. They are practical: those typically Russian two-wheeled machine-gun carts have a lower silhouette than tripod mounts. And it took the Russians to make one visible improvement on the old Maxim water-cooled machine gun that has been around since 1905: a large trap door on top of the water jacket. Throw in some snow and you're in business; also it will take urine directly in an emergency.

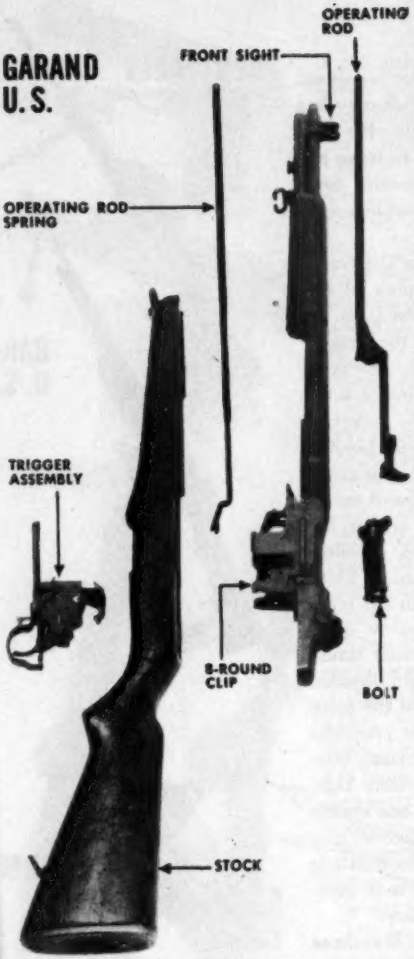
But it is in their sub-machine guns that the Russians excel in calculated crudity. In these burp guns, the plumbers have all but eliminated the gunsmiths. The Germans contemptuously called them "Woolworth Guns." But they came around to them in the end.

The original sub-machine gun was the U. S.-made Thompson, known to Prohibition gangsters as the "Chicago piano." It fired the .45 automatic-pistol cartridge from a round, drum-like magazine, and its precise gunsmithing was reflected in its price that ran well into three figures.

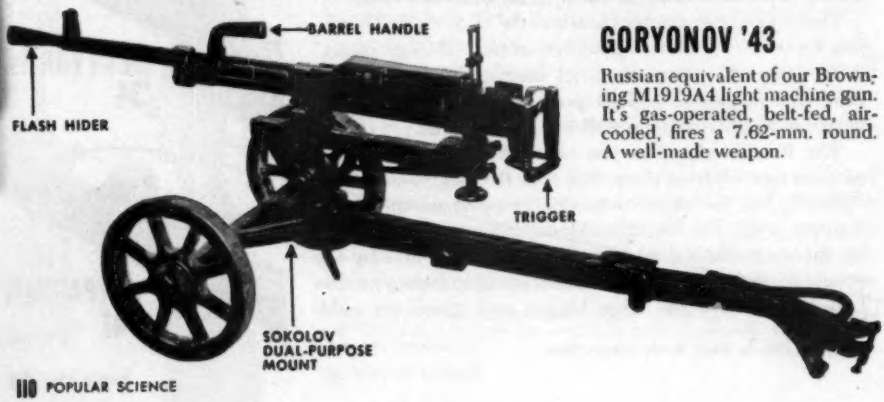
The Russian choppers you have seen in so many Red pictures took off from there. The first, the Degtyarev Model 1934-38, has the drum magazine snapped on under the wooden stock. The Shpaghin Model 1941 can be identified by the magazine mounted well into the gun, and by the extension of the pressed-steel barrel shield to form a muzzle brake. Both have the large trigger and guard for cold-

*Copyright, 1950, by Roger Marsh, Hudson, Ohio.

GARAND U.S.



TOKAREV



GORYONOV '43

Russian equivalent of our Browning M1919A4 light machine gun. It's gas-operated, belt-fed, air-cooled, fires a 7.62-mm. round. A well-made weapon.

weather use. Anyone who has handled a Garand with gloves on knows the importance of this feature.

The Model '42 Sudarev, however, is the ultimate triumph of the plumbers: it is made almost entirely of pressings and stampings, except for the barrel and breechblock. The muzzle brake is simply a bend in the barrel shield. In this model, the drum gives way to an in-line magazine, curving down from the body, which is also the forward grip.

SUDAREV '42

Like our own "grease gun" and the earlier Sten, all of these guns are designed for easy manufacture and operation *without* close tolerances. The actions just slam back and forth along guides with hardly a thought of tolerances or mud. They look even cruder and cheaper than our grease gun — which got down to around 12 bucks. And these bargain-basement jobs can kill you just as dead as the original, beautifully made Tommy gun.

This is the hard lesson for all of us who have inherited the tradition of mechanical perfection from the great gunsmiths of Europe through the Pennsylvania and Kentucky rifles and the precision products of Whitney, Colt, Remington, Winchester, Smith & Wesson, and all the others.

When it was man against man, gun against gun, the man with the most accurate and reliable weapon had the best chance. And it was our own Eli Whitney, you remember, who made mass production possible half a century before Ford. His muskets had interchangeable parts and did not have to be made and fitted one by one—lock, stock, and barrel. If a hammer broke, another would work as well.

The Russians, in effect, have made the whole gun interchangeable by making more and cheaper guns. And they have made all their weapons to be expendable, as they have made men disposable.

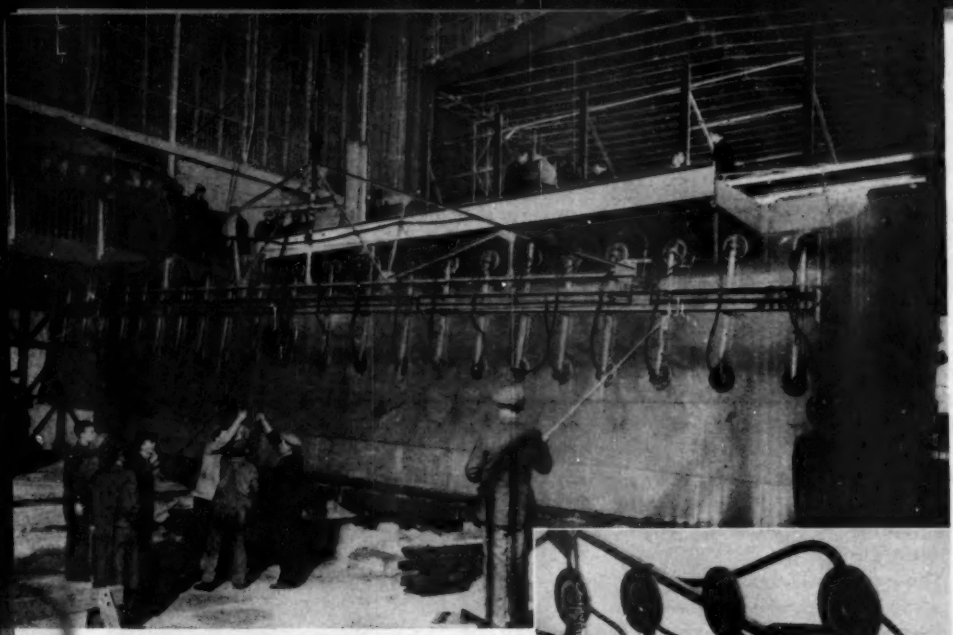
We know how to clip man-hours and materials and come up with even better cars and beer cans. But in weapons our tradition dies hard. We like to start with the best and make substitutions reluctantly. For instance, there were many corner-cutting substitutions authorized for the Garand. But I've never found anybody who saw a Garand incorporating all these modifications.

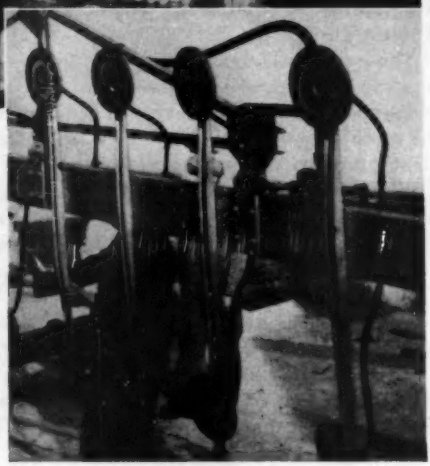
Close-up of welding on Russian copy of Sten gun.

We had to redesign our thinking to come up with the grease gun. This give-away job was developed, not as the *best* gun, but as a product design *best fitted* to its use and manufacture. It has the tolerances of a two-bit cap pistol, but it works very well because close tolerances were designed-out. It's an ugly, clanking killer, but it's as dependable as it is expendable, and is now standard for the U. S. armed forces.

Probably there's no better example of the only way we can multiply limited man-hours with unlimited mass production to meet the challenge of sheer manpower. END

U. S. M3
"GREASE GUN"





Vacuum Lifts "World's Biggest" Plate-Glass Window

THE picture above shows a tense moment in preparation for the forthcoming Festival of Britain on the south bank of the Thames River. A polished plate-glass window, said to be the world's biggest, is being hoisted into position by a vacuum gripping device. The window is 50 feet long, 8 feet wide, and ⅜ inch thick. Forty-four sucker pads mounted on a steel beam held the glass while a crane swung the big sheet into position. A pump and tubing exhausted the air from the pads.

Small British Ambulance Plane Carries Litter Patient

BY HINGING the top of the fuselage, as shown at left, a British company has made an ambulance plane out of a small, single-engine lightplane. Made by the Chrislea Aircraft Co., the Sky Jeep will carry a full-size stretcher, patient, nurse, medical equipment, and pilot.

As a conventional lightplane, the Sky Jeep has a capacity of three adults in the cabin besides the pilot. It has a maximum level speed of 130 miles an hour, and can take off in 540 feet and land in 390. The total weight of the plane is 2,550 pounds. It is powered by a 155-hp. Cirrus engine.

By Michael Amrine
DRAWINGS BY RAY PIOCH

How to Build A Family Foxhole

TO OUR READERS:

THIS is a condensed, down-to-earth handbook for home survival, told mostly in pictures and check lists.

Much that has been printed about "What to Do When the A-Bomb Comes" is tragic nonsense—aspirin for cancer. Even the official booklets say mainly, "Keep calm, keep covered, and follow directions." The $64 questions are, "What directions, from whom?" and "How calm can you get?"

Too many directions for taking atomic attack assume adequate warning, full military protection, and a civil defense operating like a well-run public utility.

Such a civil-defense organization simply does not exist on a scale comparable to the problem. The hard truth is that the most you can expect from civil defense will be control and rescue work *after* a bombing. The most effective preparation for atomic attack will be family by family, house by house.

So your civil defense begins at home—particularly for the two-thirds of all families that live in individual houses. It is estimated that half the probable casualties might be avoided by proper preparation.

Here, then, is what you can do with *planning and plain hard work* to increase your family's chances of survival. Most of the things you can do right now are things you should do anyway to make your house a safer place to live, come what may . . .

All of the ideas are practical and possible in the experience of those who know the factors involved. The author, Michael Amrine, has long been identified with atomic affairs, and formerly served with the Atomic Energy Commission. However, the opinions expressed here are his own and the editors', and do not necessarily reflect the official views of the many atomic experts, national and local civil-defense authorities, engineers, builders, and others consulted. ***—the Editors.***

PS Handbook for Survival continued on next page.

A refuge room in your own house is the best defense against atomic attack.

YOU cannot escape an atomic bomb, but there is something practical and patriotic you can do to prepare for atomic attack. A millionaire could not construct a completely A-bomb-proof shelter, but *the average householder can make a worthwhile refuge room in the average basement.*

It will help to know what NOT to do.

- Don't blackout your house. With radar bombing and, possibly, guided missiles, lights won't make much difference. Along the coast, however, the sub danger may require dimouts.
- Don't tape windows. It's practically useless against an A-bomb blast.
- Don't buy a Geiger counter. Unless you're an expert, it will probably only confuse you.
- Don't buy a radiation "remedy." The only help for radiation injury is rest and blood transfusions.
- Don't hoard food. If your area is so badly hit that food supply is disrupted more than a few days, you'll have to leave it behind when you get out.

First, you should know that what is to be feared most in atomic attack is not *radiation,* but the more familiar forces of *heat* and *blast*. In other words, the job is to set up protection against *a big fire* and *a big wind.*

So imagine that your house is in a cyclone or hurricane belt, and next door to a gas tank.

This means that your greatest threats are flying glass, falling objects, collapsing walls or floors. And fire. Most of the damage in Japan was from fire.

So follow these general principles in picking the place for your refuge room:

1. It should have two exits, at least one to the outside. Remember that getting *out* is as important as getting in.
2. Keep it out from under those parts of the house with heavy furniture or appliances, and away from the furnace or oil tank.
3. Pick the corner of the cellar that meets requirements 1 and 2 and has the least windows or exposure.

Once you have selected the best site, clean out the whole area. Remove all the family junk that accumulates in any cellar. Take down high shelves. Make rough shutters for any windows. Move in the heavy old table or workbench that is the white elephant in so many homes: hunching under such tables saved thousands of lives in England and Germany.

Then collect the emergency equipment, remembering that you are building a refuge, not a rumpus room. There are pictures and check lists in these pages to help you make

A-Bombs don't have to hit the bull's-eye. A near miss still destroys the target. This means people miles from a war plant are in the danger zone—and people next door to the plant need not be resigned to a direct hit (see above). Both need refuges. A shelter can save you from a burst 4,000 feet away. One may be vital for a burst four miles away.

your own plans to fit your own circumstances.

Finally, strip the whole house for action. While you will not get rid of all the family treasures and comforts, there are things around any house that would become a menace in a shaking concussion. Some of them, at least, can be disposed of where they can do no harm.

Enlist the whole family in Operation Cleanup. There isn't a closet or a kitchen cupboard or a toy box that couldn't stand a healthy weeding out. Let children help by snooping out the oily rags, furniture polish, and other fire hazards grown-ups may overlook.

And after you've done all you can, remember that nothing stays done. Inspect your equipment constantly. Go over the check lists regularly. Test your extinguishers and lights. Rotate the food supplies. Give every member of the family a specific job to do, and then get a report that it has actually been done.

If anything happens, you'll be glad you were ready. If nothing happens, you're still ahead of the game. You have just two very hard things to do: one, to get ready; two, to keep going.

In doing these things, you and your family will be assuming an attitude and forming a habit more helpful to defense than Geiger counters. By building your family foxhole, you will also be building the state of mind that can resist the pressures of aggression as well as the shocks of actual atomic war.

Protect your records, too. A bank vault is a safe place, but it might be a good idea to photostat the most valuable papers. Keep one set of copies yourself; distribute others among relatives.

Make sure these are safe: birth certificates, marriage and divorce certificates, deeds, social-security numbers, bankbooks and statements, insurance policies, military discharge records, stock and bond numbers, wills, and next-of-kin names and addresses.

Keep in your first-aid kit: a list of each persons's blood type, and notes on special physical conditions, such as heart disease or diabetes. This information, together with identification papers, should also be carried by each person at all times.

Some Answers for A-War Questions

How bad is the A-bomb? The bomb is mainly a big wind and a big fire—bigger than most people can comprehend. It can knock down brick buildings a mile away, flash-burn timber two miles away. Besides the fires set directly, damage to power lines, gas mains, lamps, and furnaces starts hundreds of secondary fires. It is this ability to destroy such a large area that makes the A-bomb a revolutionary weapon. A single bomb could knock out most of a big city's fire-fighting equipment, hospitals, utilities.

What about the H-bomb? It's still only a theoretical possibility. If perfected, it would wreak the same kind of damage as the A-bomb, but over a still larger area.

What should I do about radiation protection? Stop worrying. If you're close enough and exposed enough to get direct radiation from the burst itself, you're likely to be killed by blast, fire, or flying debris anyway. Shelter will guard against radiation, even under the bomb. If the bomb explodes in the air, as seems likely, very little radiation will linger after the burst.

Won't I be safer in a community shelter? Possibly. And perhaps more comfortable, too, since many will have shower rooms, kitchens, first-aid stations, and utilities. But you may not be able to get there during an attack. Besides, World War II experience indicates most people prefer to take their chances at home—London's ample community facilities were never fully used.

Should I build a back-yard shelter? If you lack a basement, it might be advisable. But be sure it won't cave in on you. For a 7-ft. deep, 7-ft. wide shelter, make the walls of corrugated sheet metal or 2-in. planks on 4 by 4 studs. Tie opposite wall studs top and bottom with 4 by 4s. The roof should be completely separate, with 2 by 6 rafters, spaced 16 in., supporting 2-in. planks or corrugated sheet. Support the rafters on 2 by 6 sills set in the earth outside the walls. Cover the roof with three feet of dirt for radiation protection. *Make two entrances.*

What should I tell the children? The truth. They need to know for their own safety. Teach them where to go in a raid, how to "hit the deck," and what to do if they become separated from you. Don't scare them, but don't make it a game, either.

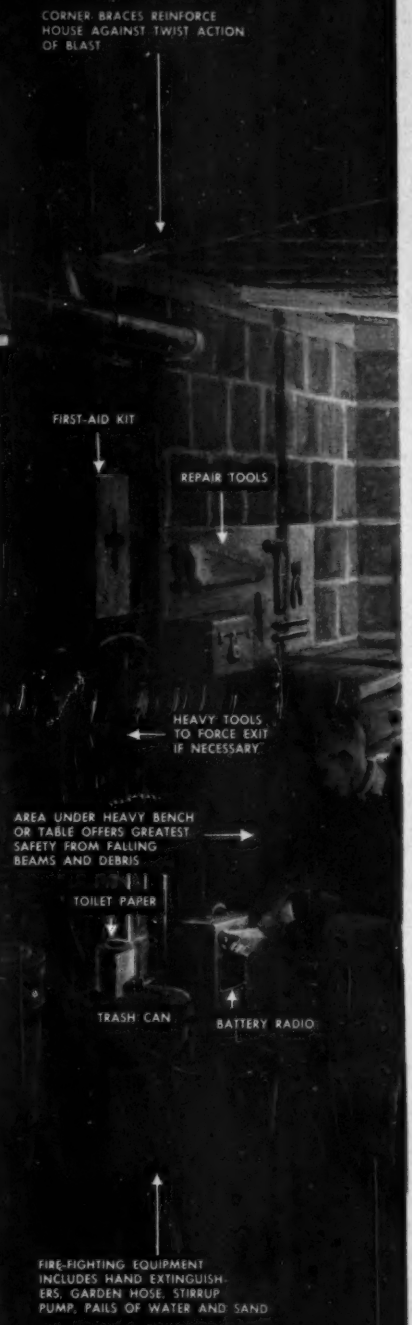
Turn the page to see one family foxhole.

PS HANDBOOK FOR SURVIVAL

What You Need in a Basement Foxhole

How well your basement refuge will protect you depends on how carefully you choose its location and equipment. As indicated in the drawing above, keep away from the furnace or oil tank (they might start a fire) and the kitchen or bathroom (their heavy fixtures might fall in on you). Outfit your foxhole for pioneer living. You may have to cook over a charcoal fire, jellied-alcohol burner, or kerosene-lamp stove. You shouldn't count on any utilities except possibly gas (the mains, deep underground, are reasonably bombproof). Water pressure may drop after a raid. The water is not likely to become radioactive, but may be polluted. So fill all available containers before the raid; water obtained after the raid should be boiled or purified with chlorine tablets. Telephone service, if not dead, will be badly jammed with emergency calls. Electricity is almost sure to be lacking.

Drawing above shows why floor near outside wall is safest place in cellar if joists fall in. But upstairs, interior partition walls are safer.



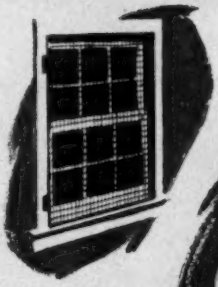
Turn the page, please, for more tips on survival.

If your house has no basement, bank earth or earth and logs against an outside wall. Put a heavy table next to that wall on the inside (inset) to catch beams if any should fall.

Safest place in basement-less home is also under table. But not near outside wall, as in cellar refuge. Choose interior, non-load-bearing partition, which is least likely to collapse.

Gully outdoors may offer more protection than lightly built, basement-less house. Lie face down, with head in crook of arm. Do this, too, if you're caught outdoors by a burst.

Underground shelter in yard may be advisable, particularly if big windows, lack of basement leave house too open. Build shelter carefully, with adequate bracing, drainage, exits.



INSIDE SCREENS STOP FLYING GLASS

CANS MAKE REFLECTORS, STOVE CHIMNEY

CHOOSE CANNED FOODS CONTAINING LIQUIDS, FOR WATER MAY BE SCARCE

PUT DECORATIVE ACCESSORIES TO WORK COOKING

Simple preparations, such as those suggested in drawings above, can help a great deal. Put screening inside windows—flying glass can be as dangerous as bullets. Keep extension cords handy for the return of power. Until then, candles in tin-can reflectors and kerosene lamp made into stove with can chimney will serve. And Colonial fireplace accessories can help cook.

Check List of What You Need in Your Refuge Room

Tools and Equipment: Jacknife, pick, shovel, Boy Scout type of hand ax, crowbar, hammer, saw, pliers, adjustable steel lally columns (to support first-floor joists), wrenches, extra door bolts, hinges, padlocks, wallboard (for covering broken windows), extension cords, lamp sockets, bulbs.

.....

Medical Kit: Salves for burns, gauze bandage, compresses, adhesive tape, splints, chlorine tablets (for purifying water), mechanic's soap (for washing off possible radioactive dust).

.....

Fire-Fighting Equipment: Hand extinguishers, stirrup pump, empty buckets, buckets of sand, buckets of water, garden hose (with coupling for attaching it to indoor faucets).

.....

Lights: Battery-powered lights, kerosene lamps, candles, drop light.

.....

Food: Canned food (choose fruits and vegetables packed with liquid), bouillon, dried milk, powdered cocoa and coffee, raisins, chocolate, dried fruit.

.....

Cooking Equipment: Skillet, teakettle, covered pot, can opener, brazier, charcoal, bricks and grate (for improvised fireplace), fireplace fittings (so you can cook in regular house fireplace), jellied-alcohol stove, extra cans of jellied alcohol, outdoor grills, clean five-gallon cans, waterproofed matches (in tin box or dipped in wax), kitchen soap, scouring powder, steel wool, basic chinaware.

.....

Clothing: Underwear, socks, old coats, coveralls, overshoes, rubbers, boots, old gloves, rain coats, waterproof fabric, sweaters, jackets, bandannas (for radiation or smoke masks).

.....

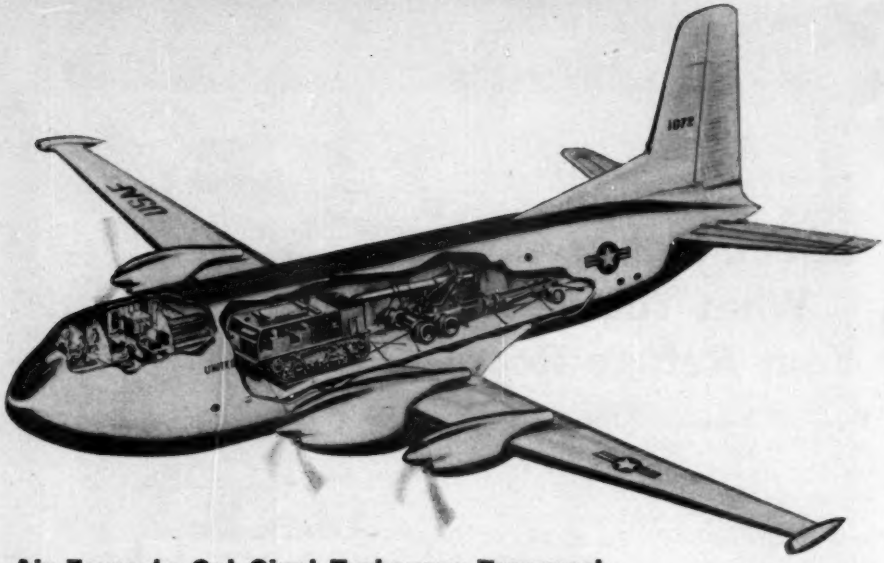
Furniture: Heavy tables, bunks, benches, wheeled cart (for basic evacuation kit), packing boxes, trash cans with lids, duckboards (for damp floor).

.....

Valuables: Extra pair of glasses, lockbox (for valuable papers), money (in small bills).

.....

Miscellaneous: Battery radio (car radio will also work), wind-up clock, maps of city and county, books, writing materials, eye goggles (for smoke or radioactive dust), old newspapers.

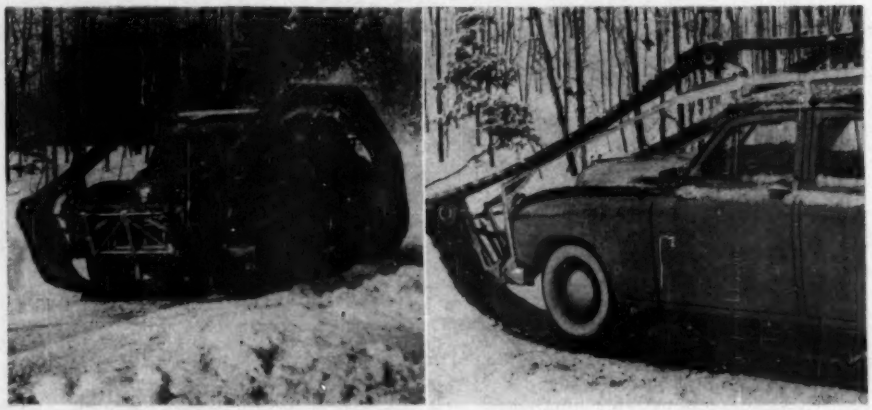


Air Force to Get Giant Turboprop Transport

THE U.S. Air Force's first turboprop transport airplane is in the making. A year from now the prototype of a turbine-driven Douglas C-124A Globemaster II, capable of transporting more than 37 tons, will be ready for its test flights.

This will be the first adaption of the gas turbine, heart of all the USAF's jet fighters and bombers, to military transports. So equipped, with turbines turning propellers instead of supplying jet thrust, the Globemaster will fly faster and farther with a 12½-ton greater load than it can now with reciprocating engines.

The flight deck will be pressurized. Despite a boost in the gross weight from 175,000 to 200,000 pounds, the plane's take-off distance will be reduced and it will climb faster. That's because its 22,000 horsepower will almost double the power of the piston-engine version, which has been in production for a year.



Caterpillar Tracks Encircle Car for Snow Travel

HEAVY snow won't stop cars fitted with these "snowshoes." They are full caterpillar tracks on a frame that fits over an ordinary automobile. The rear wheels drive the tracks, while a bar controlled by the steering wheel operates emergency-brake cables for turning. Leonard N. Le Page, the young Roseville, Mich., toolmaker who invented the snow tracks and has been testing them, reports they can be put on in an hour.

Two Records Tell 256 Stories

YOUR junior disk jockey will keep himself busy with these phonograph records that tell a new children's story every time they're played. A tricky grooving method that puts four separate sound tracks on each record side makes it possible for two disks to spin as many as 256 yarns.

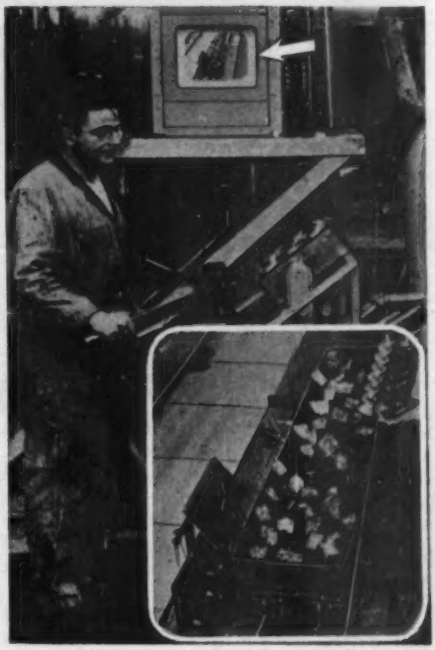
The four separate tracks start at points 90° apart on the margin of the record, spiral inward as shown in the drawing, and then converge near the center in a common run-out groove that trips an automatic changer. When the needle is set down, chance alone determines which of the four grooves will be engaged.

The stories are worked out in dovetailing sequences so that any one of the four stories on the first side will be logically continued by any one of the four on the second side, and so on throughout all four sides. Since there are four stories on each of four sides, the total number of possible combinations is 4 x 4 x 4 x 4, or 256.

The Atlantic Recording Corp., of New York City, sells the two-record album, called "The Adventures of Johnny," for $2.35.

Industrial TV Helps Load Scrap Into Railroad Cars

WITH the aid of a television screen (arrow), the General Motors worker at right can see how he is loading metal scrap into railroad cars outside the plant. From his control panel he operates a compressor that squeezes scrap into blocks and a conveyor that carries them to the car. He can also move the car as it fills up so the load will be evenly distributed. The TV camera is mounted on the roof of the building and transmits pictures to the screen in the plant. The inset shows a close-up of the screen.



New Harmonica Has Horn on Side

THE amplifying horn on the new plastic harmonica below helps a beginner sound like a professional, according to the Magnus Harmonica Corp., of Newark, N. J. Moving a hand over the bell of the horn produces violin sounds and other special effects. Tuned in the key of C, the washable instrument has six holes and 12 reeds. It is 3⅞ inches long, and comes in red, blue, and green. It is priced at about 40 cents.

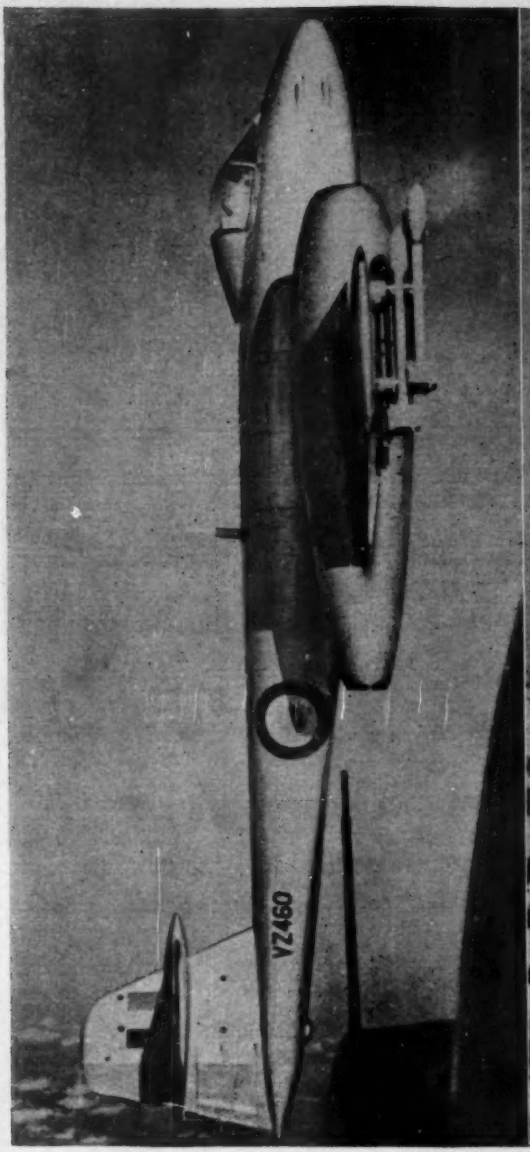
Here Are Jets Under Two Flags

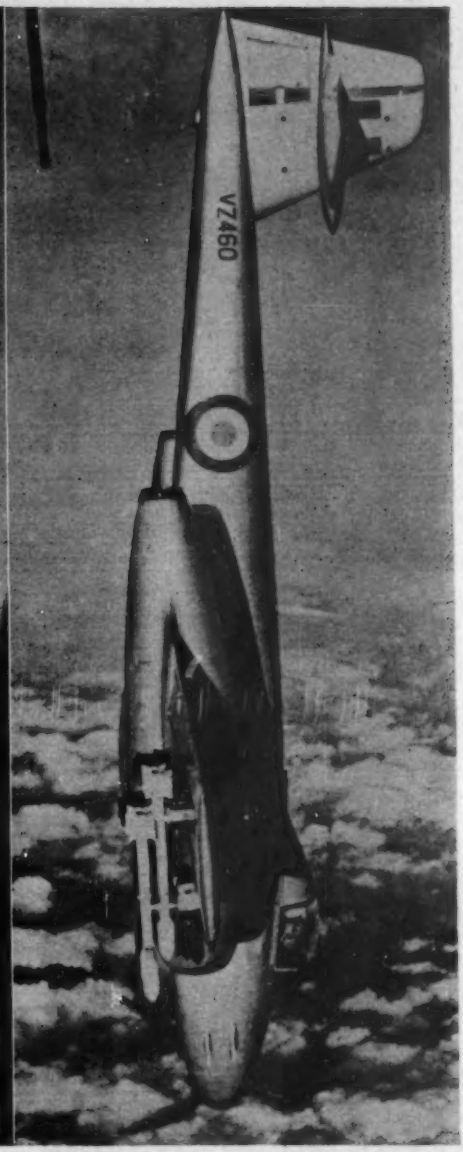
First U. S. Swept-Wing Fighter-Bomber Tested

FOR the first time since the jet airplane became a factor in the world's air forces, the USAF is going to be liberally equipped with a swept-wing plane designed both for fighting aloft and for attacking enemy ground troops. Republic Aviation Corp. of Farmingdale, N. Y., will produce the planes in quantity.

A modification of the straight-wing Thunderjet thrown against the Communists in Korea, the new plane is designated the F-84F. Its fixed armament consists of six .50-caliber machine guns. It can carry up to 24 five-inch rockets. With two 1,000-pound bombs it can also tote 18 rockets. Its speed is "well over" 600 miles an hour.

Now see the opposite page for a British version of the fighter-bomber.





British Fighter-Bomber Can Chase Angels

ONE British version of the fighter-bomber is the Gloster Meteor F Mark 8. It has a rocket-like climb, attested to by the picture above of its vertical ascent. Unlike the newest fighter-bomber of the USAF, it does not have a swept-back wing. Powered by two jet engines, it can fly at 585 miles an hour at 10,000 feet.

The two pictures were taken by Russell Adams, Gloster Aircraft Co. photographer, from the rear seat of a companion plane as the two planes looped together.

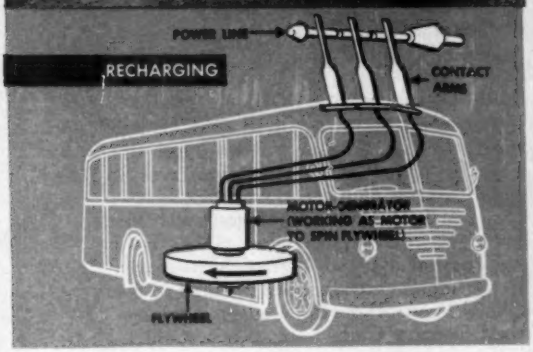
Gyrobus looks just like gas-driven one when running in street (above). But power comes from generator turned by free-spinning flywheel (drawing, right). To bring rotor back up to speed along route, some stops are "recharging" points. As shown in photo and drawing at far right, contact arms feed generator, which now acts as motor to speed up flywheel again. System provides fairly steady power though rotor is always slowing. Top speed is 32 m.p.h.

Swiss Bus Runs on Flywheel Power

THERE'S a bus in Switzerland that may fulfill the dreams of straphangers and city fathers alike. It has no internal combustion engine to make noise or fumes, no trolley wires to tie it to a restricted route, no clumsy storage batteries to eat up weight and space. Its power comes from a big, free-spinning flywheel.

The flywheel, "wound up" to speed in the garage, turns a generator that feeds an electric motor to drive the rear axle. There's no connection to outside power when the bus is moving, all the driving energy coming from the inertia of the steel flywheel, which is about six feet in diameter and weighs more than a ton.

Friction losses are so nearly eliminated—the rotor spins on specially lubricated, heavy-duty ball bearings in a case filled with



hydrogen (which offers less resistance than air)—that it will run for 10 hours without load before stopping. Even pushing a 12-ton bus, a single wind-up should last four miles of city traffic, allowing for the usual stops.

But four miles isn't a very long bus route, so the Gyrobus makers, Oerlikon Machine Works, have provided a way to "recharge" the rotor while the bus stops for passengers. Contact arms on the roof raise to connect to a power line. A switch then lets the generator on the rotor shaft act as an electric motor, spinning the rotor back to full speed, 3,000 r.p.m.

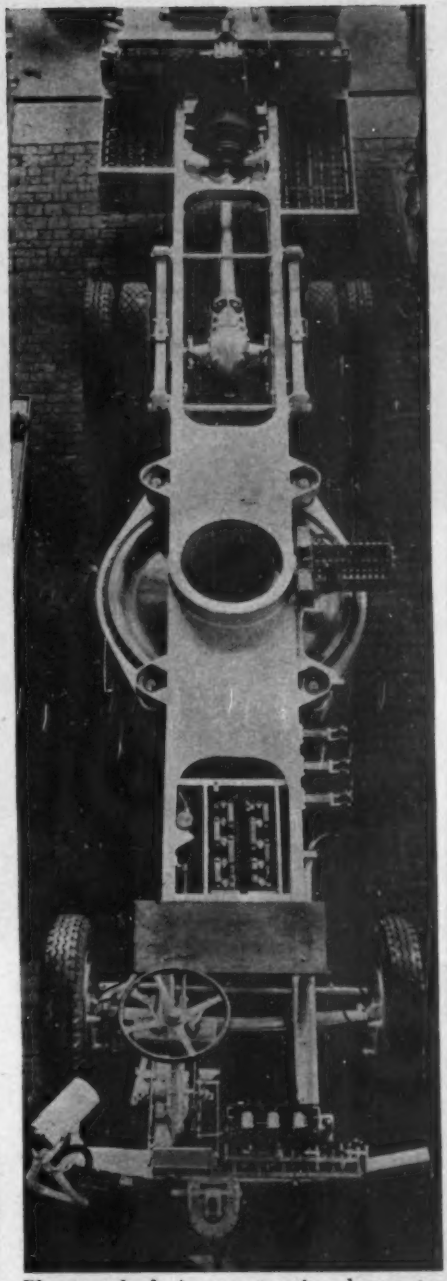


Photo made during construction shows rotor (center) without motor-generator. In rear is driving motor, surrounded by control equipment. Bus has batteries for lights and controls.

Sketch is made by drawing with a sharp stylus on a strip of carbon paper backed with celluloid. Note mirror and lens on lid.

Drawing and Diagram Projector Is Lecturer's Aid

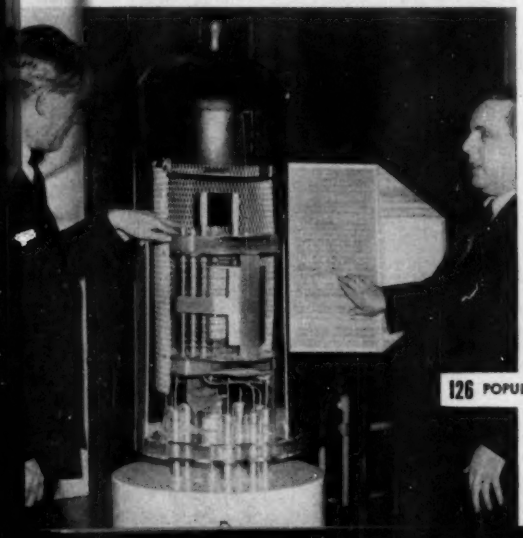
THE speaker above can sketch blackboard illustrations for his lecture without having to crane his neck to face an audience. As he draws on the device before him, the image is projected by an arrangement of mirrors onto a screen. Called the Screen Scriber, the projector, at right above, was invented by David O. Woodbury, a writer of La Canada, Calif. The Army is testing it as a new educational tool.

Blind "See" How Radio Tube Is Built

THE giant radio tube below is 30 times the size of a miniature electronic tube, duplicating it in every detail. The model was made by the Mullard Electronic Products, Ltd., of London, to enable blind persons to visualize how a radio tube is constructed. In the photo, blind man at right reads Braille description with his fingertips and explains the various parts of the tube as they are touched by his friend.

Radio-Controlled Cart Caddies, Mows

THE tired businessman without enough energy to tote a heavy golf bag can still enjoy the game and do his club a favor at the same time with the contrivance below. Designed by Jim Walker, of Portland, Oregon, it's a caddie cart and power lawn mower all in one, and is remotely controlled by the miniature transmitter pictured in the golfer's hand. Here it's used at the Lakewood Country Club, Long Beach, Calif.



Skiing Fans Get Manmade Snow

Skiers can now make it snow while the sun shines with this new artificial-snow machine that works like a refrigerator.

By George H. Waltz, Jr.

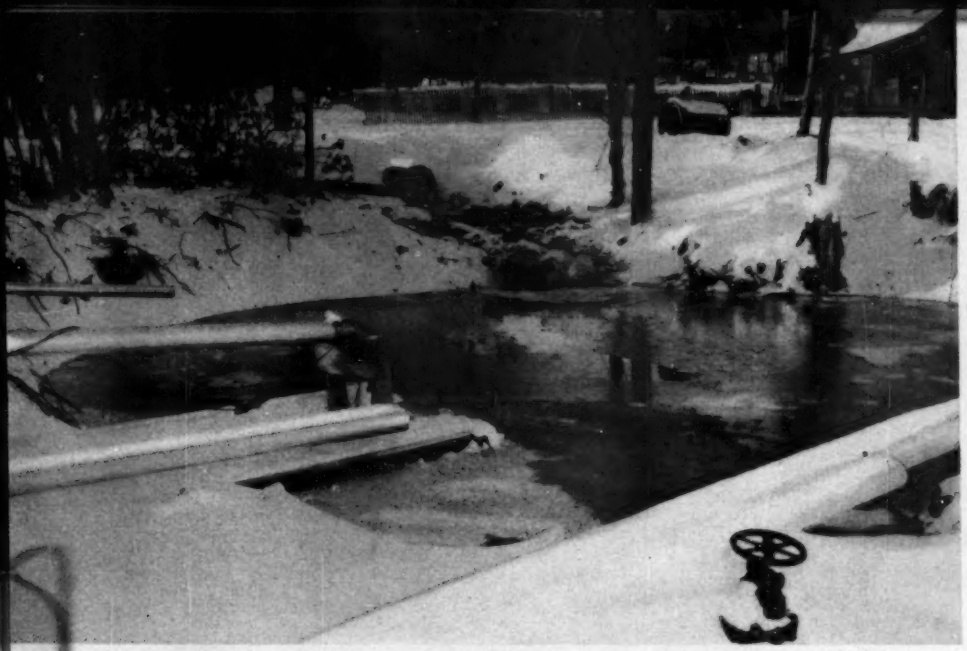
PS PHOTOS BY W. W. MORRIS

NOW they're making artificial snow for skiers when the weatherman fails to provide the natural variety. And they aren't doing it by seeding clouds with dry ice or by feeding crushed ice into air blowers. They're doing it the same way your refrigerator works—by cooling a liquid through the rapid expansion of a gas. The liquid is water and the gas is air.

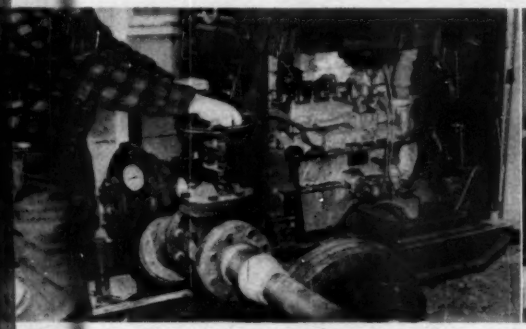
The snowmaker, now being tested on the Big Boulder ski slope at Split Rock in Pennsylvania's Pocono Mountains, consists of a special nozzle through which a high-pressure mixture of air and water is sprayed at supersonic speeds. As the air leaves the tiny holes in the nozzle, it expands and loses heat so rapidly that it chills the water spray to form tiny crystals of snow.

According to the inventors, the technical staff of the Tey Manufacturing Corp., of Milford, Conn., any kind of snow, ranging from the coarse granular variety to fine powder, can be made by varying the proportions of air and water.

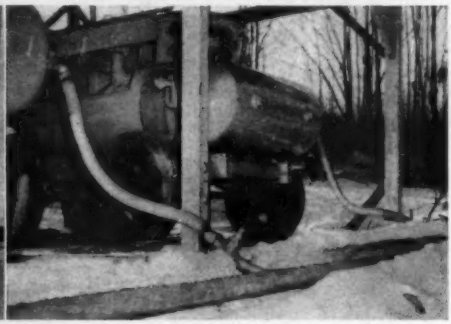
At Big Boulder, where a special demonstration was staged recently for PS, fifteen



Good supply of water is important. At Big Boulder ski slope in Pennsylvania's Pocono Mts., water is drawn from pool fed by stream. Pipe in left center leads to pump house.

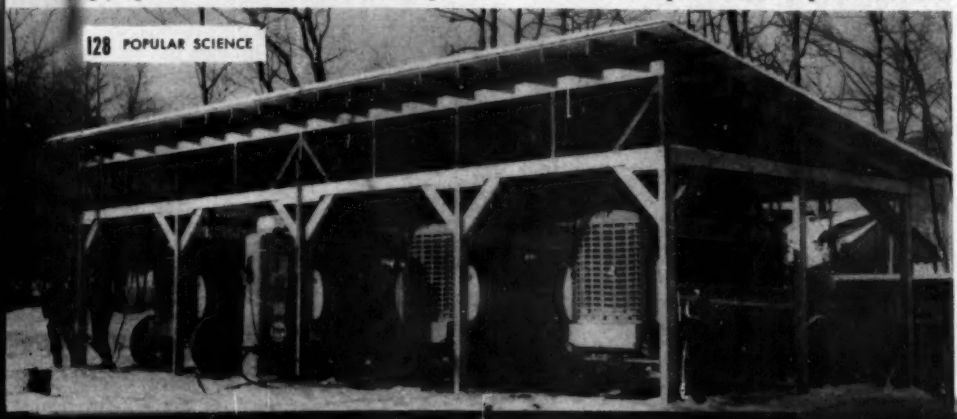


Gasoline-driven pump draws water from pool and feeds it under pressure to the 4-in. aluminum pipe that runs up the entire length of the 1,900 ft.-long skiing area.



Diesel-powered compressors supply the high-pressure air needed in the snow making. The air line, also 4-in. aluminum pipe, parallels the water line up the side of the slope.

These four Diesel units are capable of supplying 500 cu. ft. of air a minute at pressures up to 105 p.s.i. In demonstration for PS, air and water pressures of 40 p.s.i. were used.



such nozzles can be put into operation along a 1,900-ft. ski slope. Air and water pipes, provided with a series of take-off valves, run up the full length of the skiing area. Thus the plastic hoses that feed the nozzles can easily be connected into the supply lines at any point to provide snow wherever it may be needed to cover bare spots or make a new surface. Valves at each nozzle allow the air-and-water mixture to be varied to produce the type of snow desired.

Take-off valves are spotted along the air and water lines. Plastic hoses leading to the snow-making nozzles can be connected at any point on the slope where snow is needed.

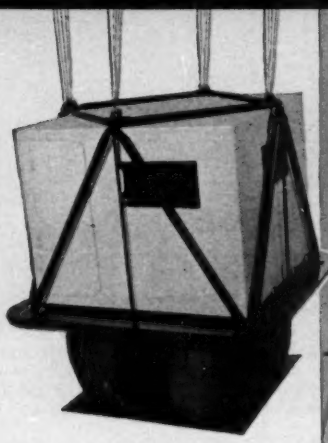
Uses Two Miles of Aluminum Pipe

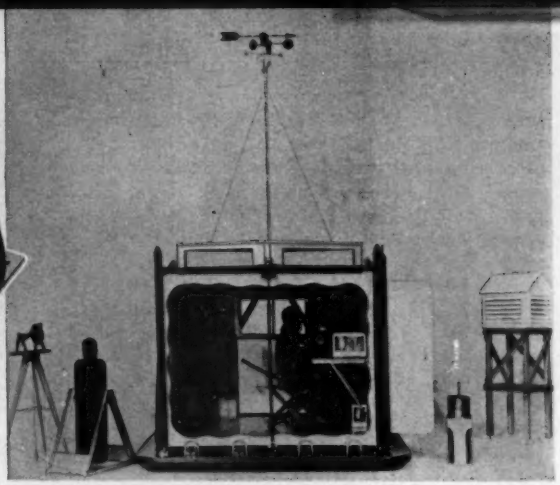
Four 112-hp. Diesel-powered compressors provide the large quantities of high-pressure air needed, while a gasoline-driven pump supplies the high-pressure water. So far, in tests, air and water pressures of 40 pounds per square inch have proved best. Almost two miles of four-inch aluminum pipe are required for the main air and water feed lines that extend up the ski slope.

Under ideal operating conditions, which means an outdoor temperature under freezing but above 10° F., the $80,000 Big Boulder installation is designed to make a ton of snow a minute. It has been estimated that with all nozzles operating, it will be possible to blanket the entire 400,000 square-foot ski area in 45 hours. With the new snow-making equipment, Big Boulder's operators hope to be able to offer good skiing earlier in the fall, to have better skiing all winter long, and to extend the season far into the spring. END

Snow-making nozzles usually are mounted on metal tripods so that snow is sprayed out at a height of about 5 ft. This allows the snow crystals to form completely before settling.

Close-up of snow nozzle above shows ring of small-diameter holes through which air-water mixture sprays at supersonic speeds. At right above, rapid expansion of air as it leaves nozzle cools water to form tiny snow crystals that settle on ground to form a blanket. When not in use, nozzles are disconnected and lines drained to keep water from freezing.

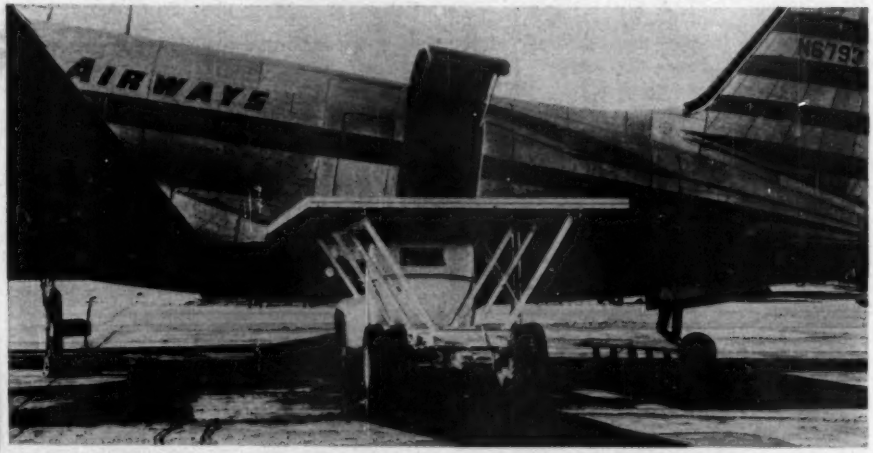




Parachute Container May Land Squad of Troops

THE U. S. Air Force may someday parachute entire infantry squads in containers from airplanes. Engineers of the Air Materiel Command at Wright-Patterson Air Force Base in Ohio are getting ready to test such a container, capable of holding 3 tons of personnel and equipment.

If the system is adopted, it will be the first time men have been dropped in a box. The container consists of a tubular framework walled with aluminum sheet. A single 100-foot parachute may be used for loads up to 1½ tons and two for 3-ton loads. Four air-filled rubber bags on the bottom of the box will cushion its landing. The container may also be used to drop a complete weather station (right above), rescue station, or Arctic-survival hut.



Pre-Loading on Truck-Top Platform Speeds Air Freight

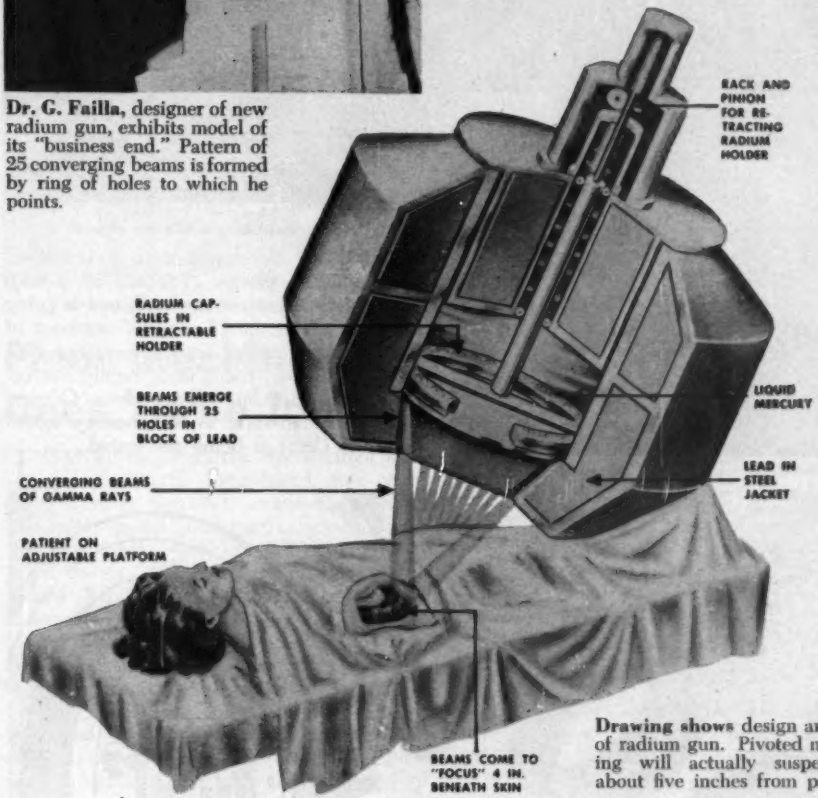
THE simple platform-superstructure shown above mounted on a truck chassis was designed by Air Cargo Terminals at Kansas City, Mo., to speed up the loading and unloading of cargo aircraft, thus saving precious plane time on the ground.

Instead of transferring individual items to a plane waiting to take off, a complete cargo load is prepared in advance and placed aboard the big platform. When an aircraft is ready to receive its load, the truck is driven to the plane, and the driver positions its cargo-door-level platform for a quick transfer.

Cargo Ready-Load is made by the Crimsco Manufacturing Division of Truog-Nichols, Inc., Kansas City. Each superstructure is custom-built for a specific truck chassis.

"Big Bertha" Beams Radium

Dr. G. Failla, designer of new radium gun, exhibits model of its "business end." Pattern of 25 converging beams is formed by ring of holes to which he points.

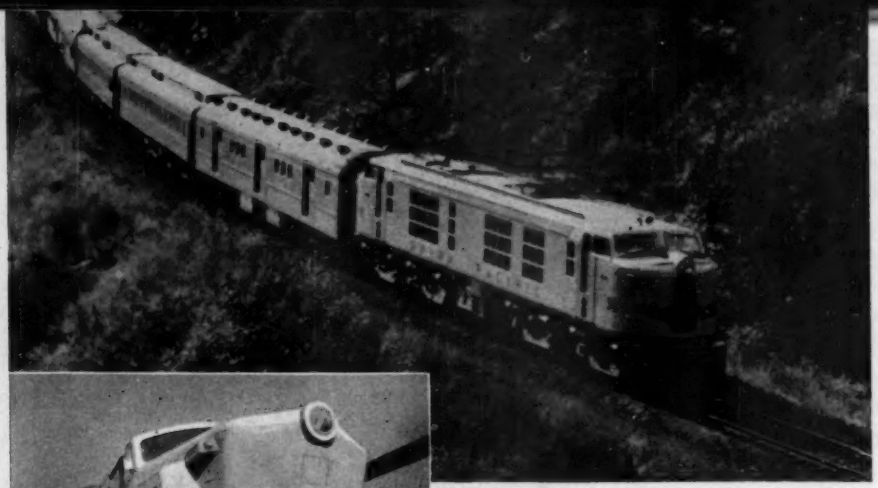


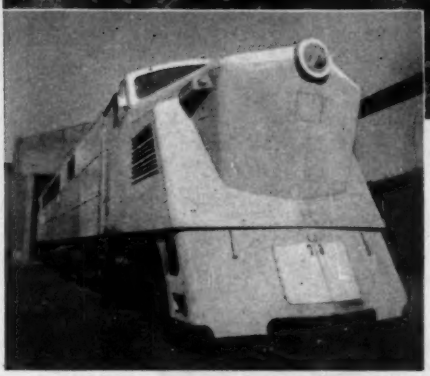
Drawing shows design and use of radium gun. Pivoted mounting will actually suspend it about five inches from patient.

A $250,000 radium "gun" will begin treating cancer patients this spring at Roosevelt Hospital, New York City. It will wield the largest amount of radium assembled anywhere for medical use—50 grams, valued at $1,000,000. Experts hope one-hour treatments will prevent serious cases of cancer from reaching advanced stages.

The 3½-ton gun employs a novel and simple design worked out by Dr. G. Failla, of Columbia University's College of Physicians and Surgeons. Within a massive casing of steel-jacketed lead, a 12-inch ring-shaped holder contains the radium in 25 capsules. Through corresponding holes in the lead casing, a sheaf of converging beams is directed upon a patient. All 25 beams come to a "focus" about four inches beneath the skin to treat deep-seated tumors. Thus their destructive power is concentrated where it is wanted, and not upon the skin, where only six beams overlap.

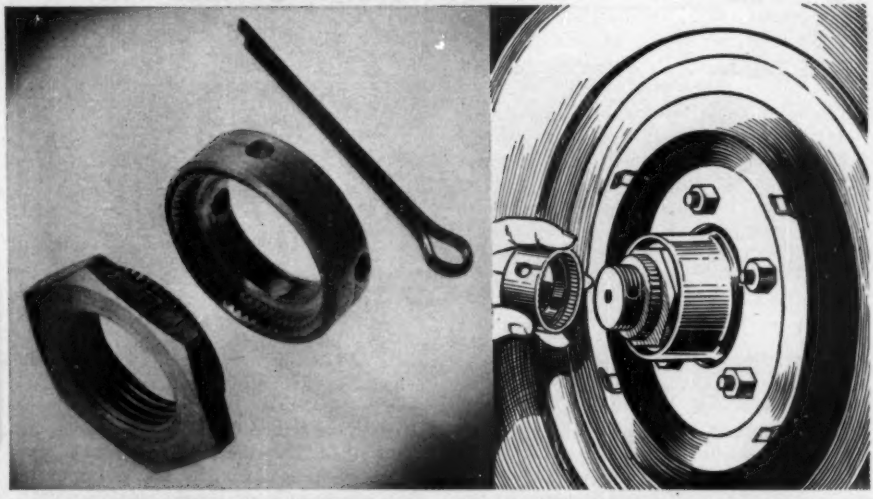
Though radium emits its rays constantly, the gun can be turned on and off. A remote-controlled, motor-operated plunger retracts the radium holder into a tankful of mercury, interposing about five gallons of the liquid metal between the capsules and the ray-exit holes. The mercury acts as shielding and shuts off the rays. END





Turbine Locomotives Go to Work

THE latest development in locomotives, the gas-turbine electric (PS, July '49, p. 98), has passed its preliminary tests and is going to work. After an 18 months' workout of the prototype under actual operating conditions (above), the Union Pacific has ordered ten 4,500-hp. versions from General Electric. Meanwhile, Westinghouse's 4,000-hp. rival (left) is being rail-tested.



Two-Piece Nut Simplifies Front-Wheel Bearing Adjustment

TROUBLESOME front-wheel bearing adjustments are simplified with this two-piece nut. The threaded hexagonal part is screwed onto the axle until just the right pressure is exerted against the antifriction bearing. Then the round collar is lined up with the hole in the axle, snapped on the hexagonal portion, and the cotter pin inserted. Interlocking teeth allow adjustment to line up the pin holes without changing the adjustment of the main nut, as is usually necessary with the regular castellated type. The nut is made in all sizes by the Advance Service Co., of Los Angeles.

Whirling brushes on machine's scrub-polish base whip up soap suds to clean floor.

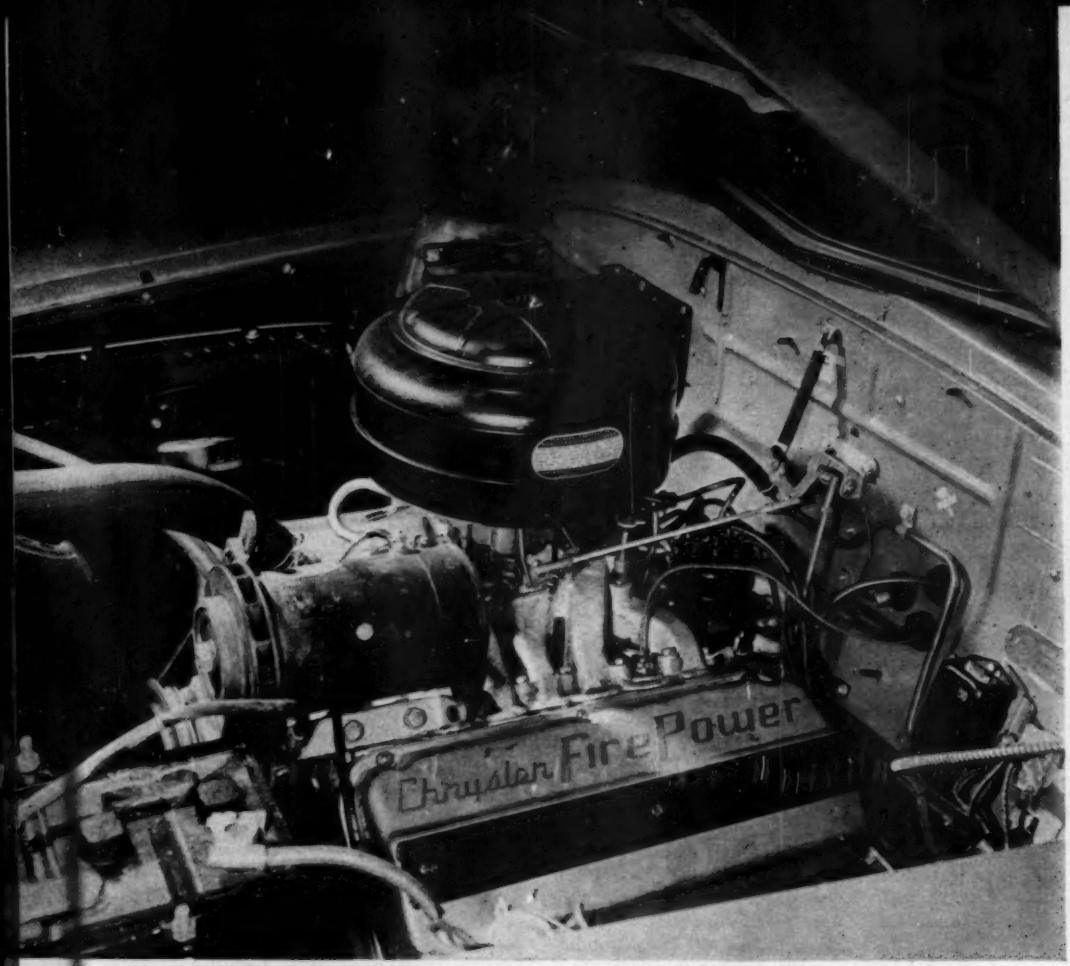
Floor Machine Does Three Jobs

THANKS to a versatile electric floor machine, recently introduced into this country from England, a housewife now can scrub, polish, and vacuum-clean floors with the same appliance. Consisting of a ⅓-hp. motor and vacuum blower on a forked handle, the machine has interchangeable bases for different cleaning jobs. One base polishes or scrubs wood, cork, linoleum, rubber, or tile; another vacuum-cleans rugs. Distributed by Columbus, Inc., of New York City, the cleaner is priced at $185. A tank for drawing off dirty scrub water costs $40. A set of furniture-cleaning tools is also available.

Dirty suds water is drawn off the scrubbed floor by the nozzle attachment above. Water flows through an extension hose into a tank, fastened to the cleaner in place of the polishing base.

As the polisher glides across the wood floor below, dirt is sucked into the dust bag. Special brushes are attached to the base for the burnishing operation.

Motor and vacuum-pump unit is about to be fitted into the vacuum-cleaner base at right below. Wing nuts hold it in place. The scrubbing and polishing base is at left.



Chrysler's new 180-hp. V-8, shown here in a 1951 New Yorker model, has over-all crankshaft length of 26 9/32 in. compared with 37 17/32 in. for 1950 L-head in-line eight. Engine's height is 36 in., width 34 9/32. Bore is 3 13/16 in., stroke 3 5/8 in. and piston displacement 331.1 cu. in. Valve lifts are highest in industry for overhead design.

Chrysler Lifts Hood on Most Powerful Car Engine

New 180-hp. V-8 boosts power one-third over earlier straight eight, has 7.5 to 1 compression, and likes regular gas.

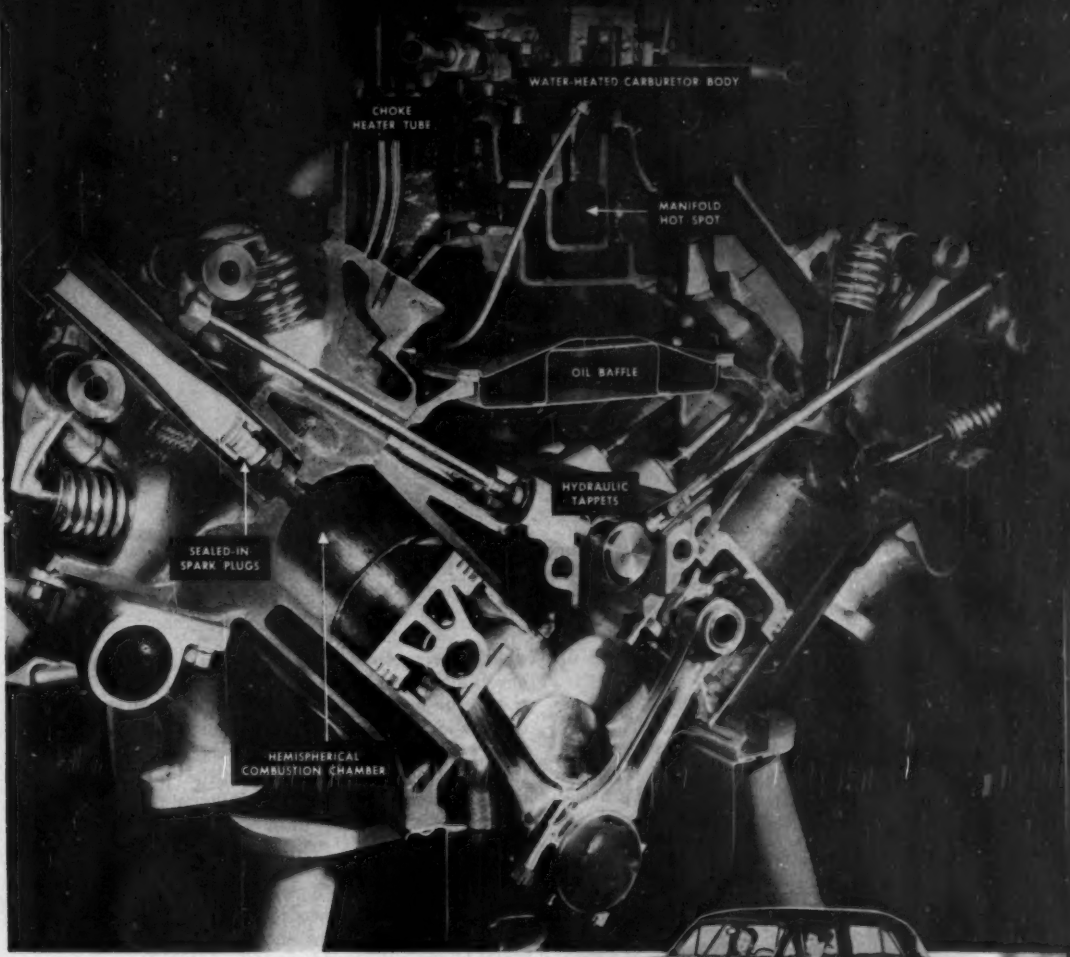
By Devon Francis and Frank Rowsome, Jr.

PS PHOTOS BY HUBERT LUCKETT

THE dream of every automotive engineer is an engine that will produce a lot more power and use less gas. Last month the Chrysler Corporation announced that it had one—a brilliant new overhead-valve V-8.

Here's what Chrysler claimed for it:

- 180 horsepower at 4,000 r.p.m.—the most



Camshaft, pushrods, double rocker shafts stand out in this display cutaway. Engine has five main bearings, uses 3-ring pistons. At right is 1951 Chrysler Imperial.

powerful passenger-car engine being made;

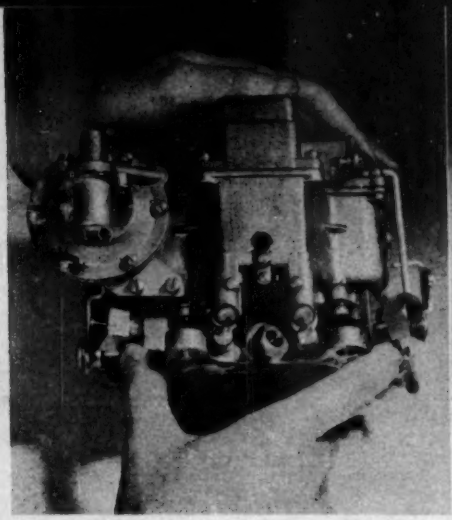
- A compression ratio of 7.5-to-1 without knocking on *regular gas;* and
- Fuel consumption averaging 10 percent *less* than that of the previous big Chrysler engine, a 135-hp. L-head straight eight.

What this means is that the new engine gives 33 percent more power, on less gas, than the old engine, which had practically the same piston displacement. Moreover, the fuel burns so completely in its combustion chambers that the problem of carbon deposits practically disappears.

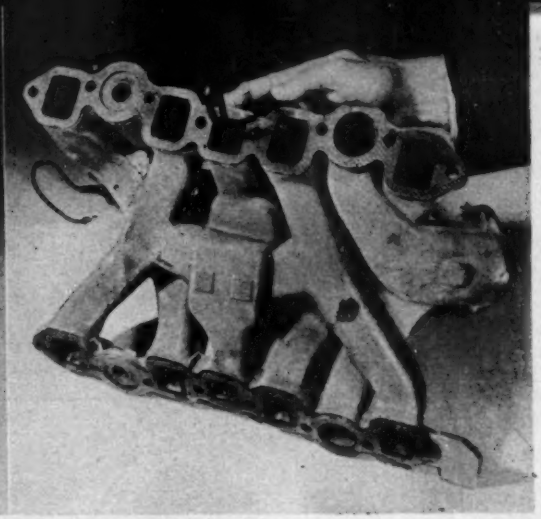
All this sounds incredible in view of the number of engineering brains that have been working on better engines for the last half-century. Progress has usually come in little steps, a bit more horsepower here, a little less friction there. But Chrysler's new V-8 performs like a big stride.

The heart of this engine is a type of combustion chamber new to American automobiles. Engine designers in past years have put all sorts of weird-shaped heads on top of the cylinders to make the fuel-air charge burn evenly, without pinging, as compression ratios have gone up.

Chrysler has adopted a plain hemisphere



Water-jacketed throttle body is Chrysler's answer to problem of carburetor icing and stalling on moist, cool days. Hand shows inlet and outlet on carburetor base for warm water.



Intake manifold is divided into two sections, each fed by one side of dual carburetor. Each section feeds mixture to two center cylinders in one bank, two outer cylinders in other.

for a head. Its insides are as round as an Eskimo's igloo.

That isn't all, of course, that they have done to their engine. The stroke has been clipped until it is shorter than the bore. A short stroke conserves power. To reduce the amount of machinery and cut friction, they have managed to work sixteen valves off one camshaft. The camshaft is positioned not on top of each bank but down in the V between the banks. They have bathed the valves in water to make them run cooler.

Fuel-Air Mixture Evenly Distributed

They have also devised a system of intake manifolding and carburetion that eliminates fuel condensation after the charge leaves the carburetor. By doing that they confined the function of the manifold to what it ought to be—a distributor of fuel and air to the cylinders. The manifold doesn't have to be used, as it is in most engines, as a revaporizing unit for the charge. It distributes the fuel-air mixture evenly among the cylinders.

That is ever more important as compressions go up. If the charge to one cylinder runs lean, the ignition timing must be retarded to prevent a knock in it. Retard the spark and you waste power.

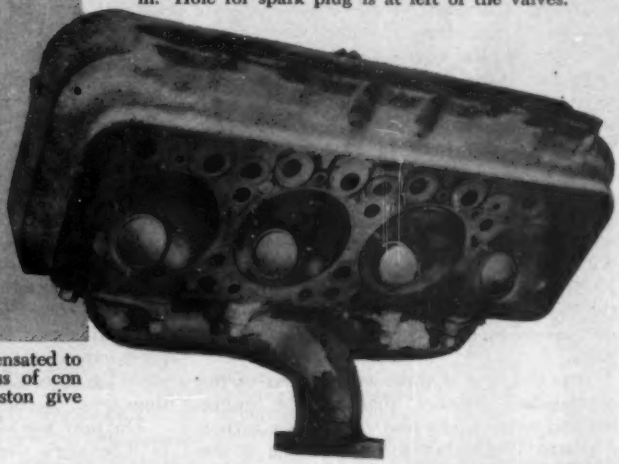
They've also put a lot of little design refinements into the engine. Things like cam lobes with unusually gradual opening and closing ramps. There's a water jacket around the throttle body to stop any tendency toward throttle icing and stalling on damp days. The automatic-choke system has been carefully calculated to lose warmth at just the same rate as the engine, preventing overchoking when the car is restarted while still warm. The distributor has a twin-breaker system that stretches out the "dwell" period, giving stronger ignition at high engine speeds.

Within the Chrysler Corporation, the V-8 is referred to as "an engine man's engine." It certainly was built with every fundamental yardstick known to the trade. The engineers started from scratch with principles known the world over. To quote from Chrysler's own description:

"It is a well-known fact that a sphere has the lowest surface-to-volume ratio of any geometrical solid. Therefore, the Chrysler hemispherical combustion chamber has the lowest surface-to-volume ratio practical in an engine employing a flat-top piston. As a result, minimum heat loss occurs through the surface of this chamber. In addition, the compact chamber ensures more complete combustion of the fuel; and the short flame travel significantly reduces combustion time".

That's big talk, but Chrysler backs it up. More of this engine's heat goes into power, less out through the radiator and the exhaust pipe. The better mileage it can get from a gallon of gas is indirectly attested to by the fact that the radiator-core area has been cut down by almost a fifth from what it was in the in-line eight, even with a third greater output. The fan diameter, the number of

Piston is temperature-compensated to control slap. Note shortness of con rod. Recesses in top of piston give clearance for high valve lift.



Hemispherical chamber, up-down valve position, show in photo of one head. Intake valves (upper row) are 1 13/16 in. in diameter, have a lift of .378 in. Hole for spark plug is at left of the valves.

blades, and the fan speed have all been reduced. That's because less heat—which means power—is dissipated to the air.

In all engines an unavoidable power loss is due to friction at the crankshaft and connecting-rod bearings, and in the valve train. However, a major frictional loss normally results from the sliding contact between the piston and the cylinder walls. This sliding friction is proportional to piston velocity, which lessens with a decrease in stroke.

The stroke of the Chrysler V-8 is only 3⅝ inches and piston speed has been decreased about 26 percent. This means that, with the same rear-axle ratio, each piston in the V-8 will travel 148,500 feet in 100 miles of driving, as compared with piston travel of 199,500 feet in the earlier in-line eight.

One effect is a marked reduction in power loss caused by friction. The new Chrysler engine produces one horsepower for each 5.13 pounds of engine, as compared with one horsepower for each 7.42 pounds in the old in-line.

If that hemispherical head is so good, why hasn't it been widely used before? The answer is that it cost too much. Hemisphere chambers have been used in some high-priced European car engines and in aircraft and racing engines. They require positioning the valves and their stems at cockeyed angles to accommodate the curve of the head. That's complex and expensive. Sometimes it has involved the use of multiple camshafts. The cost always has prohibited use of the hemispheric head in mass-produced cars.

Pivoted plastic block is mounted on side of the timing-chain cover, and springy pad presses it against chain. This prevents whip from developing as the chain loosens with long wear.

To get it, Chrysler has had to find a way to manufacture it at a price that the car buyer could afford. The engine still isn't cheap. It will go into only the two fanciest Chrysler passenger vehicles for the present. But it's here, with its king-size valves—and

those valves are the other big half of the secret that gives the new engine its extra performance.

In the Chrysler engine the valves are positioned one above the other. Due to the curvature of the combustion chamber, putting the valves side by side would have splayed out the pushrods so far in a horizontal plane that it would have taken an engine six feet long to accommodate the rods alone.

By using two rocker-arm shafts for each bank of cylinders, they kept the valve mechanism, operating off that one camshaft, within the length of the cylinder block. Even so, it took some fancy juggling with the pushrods. They angle off in two different planes to open the intake and exhaust ports.

It is the size of those valves, and of the combustion chamber, that lets the engine breathe more easily and cuts down carbon deposits. When they tore down one of the new V-8's after 40,000 miles of testing, what carbon there was could be wiped off with a rag.

The size of the chamber permitted them to put plenty of space between the valves. So the spark plug could be put nearer the center of the chamber. This results in a short flame-travel through the fuel-air charge and in better combustion. The engine has comparatively little tendency to ping because there's no hot spot in the cylinder head to fire the charge before the spark from the plug is introduced.

Chrysler says that the new engine can easily go to an 8-to-1 compression ratio—or higher—if and when better fuels become available. There is room in the combustion chamber for a considerable boost in valve size if that's needed in the future. The company expects the octane requirements to remain lower, for any given compression ratio, than those of competitive engines.

The new V-8 engine is being offered only in Chrysler's New Yorker and Imperial models for 1951. END

Scooter-Car Gives 60 Miles Per Gallon

HALF motor scooter, half car, this odd three-wheeler is built by the B and B Specialty Co., of Rossmoyne, Ohio. Ten feet long and 52 inches wide, the Broganette seats two. A 10-hp. air-cooled Onan engine is mounted in the rear. The de luxe model shown has three speeds forward, can travel 50 m.p.h., and gives 55 to 60 miles to the gallon. It sells for $550.

Rubber Baseboard Trim Turns Corners

THIS new, inexpensive baseboard, sold by the Cass Products Co., of Chicago, is made of live rubber. Used to replace worn or broken quarter-round trim, Sani-Base is easy to fit around corners and in odd-shaped spaces. It's applied with a rubber cement as shown in the photo at right. Inset shows the airtight, insectproof seal that the strip makes against the floor and wall surfaces. It is available in a variety of colors.

Toothed Belt Eliminates Slippage

THE new power-transmission belt above is said to be non-slipping and non-creeping, eliminating power loss and permitting precision timing. Called the Gilmer Timing Belt, it has built-in teeth that run on notched pulleys. The rubber-and-fabric belt will not stretch and operates on fixed centers, eliminating take-ups. Made by the U. S. Rubber Company, it needs no lubrication and, being under low tension, gives little bearing wear.

Tests have shown that the belt will operate quietly and efficiently at speeds up to 16,000 feet per minute. Successful applications have included replacing flat or V belts in television cameras, auto fans, and sewing machines, and chain drives in saws.

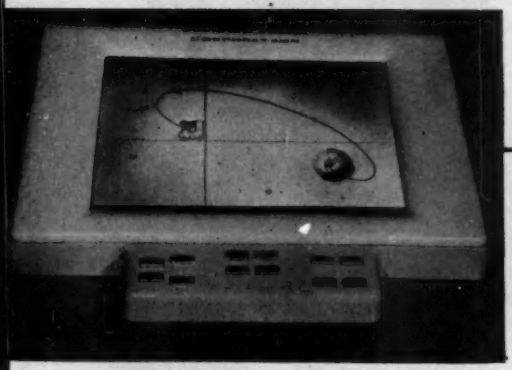
While patient strolls down street outside hospital, brain waves and heart beats are radioed to receiver inside and are recorded on oscilloscope screen. Neurologists and cardiac specialists expect apparatus to permit more accurate diagnoses.

Radio Beams Heart Beats

STRAPPED to the body of the man above is a portable radio unit that transmits his brain waves and heart beats to the receiver at left. Developed at the Holter Research Foundation, of Helena, Mont., the apparatus enables physicians to observe a patient's reactions during his normal activities instead of only when at complete rest as is done with conventional equipment.

Jet Fighter Splits in Two for Easier Maintenance

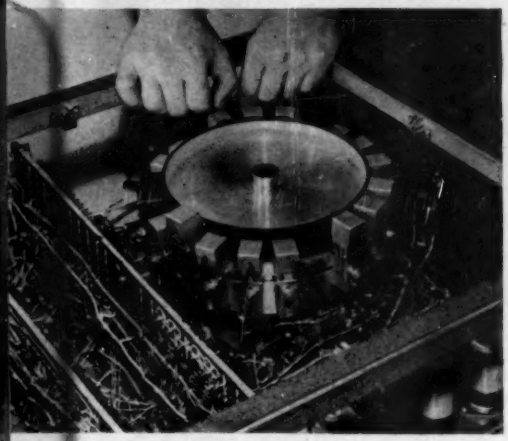
A REAL "two-piece" job is the Air Force's powerful F-86 interceptor, latest jet to see action over Korean skies. When repairs are needed, mechanics can quickly unhook the front half of the ship from the rear section, exposing the entire power plant for easy accessibility. The speedy swept-wing Sabre has hit over 650 m.p.h.



New electronic brain, which fits in desk-size cabinet (right), can be operated by office employees. It gives answers in figures or graph—above it is charting path in space of an imaginary rocket fired from the earth. It can also reverse process and turn graph into figures.

Mad Ida's Small but Smart

MAD IDA is the engineers' name for one of the newest of the electronic machines that can out-figure the human brain. Ida is a baby as computers go, smaller than an office desk and using only 97 vacuum tubes. Yet it can juggle 100,000,000 numbers a second and type out 12 series of answers at once. Ida, made by Northrop Aircraft, will start work by calculating designs for ship hulls at Stevens Institute of Technology, Hoboken, N. J. The full name? It's "Magnetic Drum Digital Differential Analyzer."



Revolving-drum "memory" (left) is only moving part. It can store 10,000 numbers on its magnetic tape and pick out any one of them.

Rocks Can't Hurt Steel-Shielded Lamps

EVEN street lights have to be tough in New York, where sharpshooting vandals pick off the lamps with hard-flung stones. One year the damages came to $300,000. Now the glass and plastic "windows" are being replaced with expanded metal — sheet steel that has been pierced and stretched to form diamond-shaped openings. Made by Wheeling Corrugating Co., of Wheeling, W. Va., it lets the light through, but not stones.

Employees Win Cash for On-the-Job Inventions

An improved milling-machine idea paid Henry Ostien, veteran Westinghouse employee, $500.

Ingenuity on the assembly line also pays a dividend of national importance today—speeded-up production.

By Bill Reiche

THOUSANDS of amateur inventors make hundreds of thousands of dollars a year without laboratories or equipment, dreaming up new production techniques, short cuts, and tools.

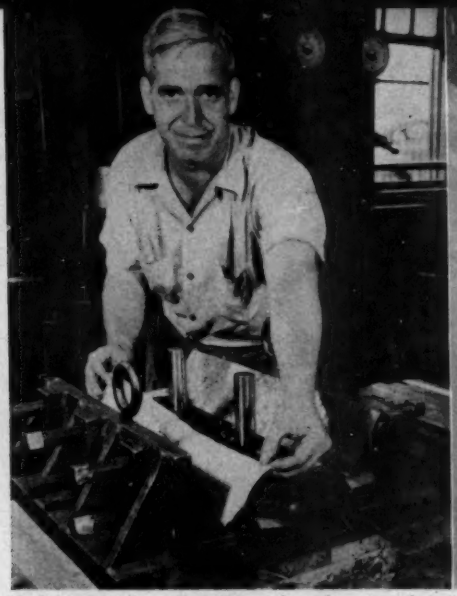
These men and women are "inventors on the job"—employees of industrial corporations that realize the brightest idea for speeding production, cutting costs, or improving products may come from an assembly-line worker as well as an engineer.

These companies set up suggestion systems whereby anyone in the organization can offer ideas that may improve plant operation. Westinghouse Electric Corporation conducts a successful system on the basis that "no one of us is as smart as all of us." Started in 1910, it has paid out more than $1,300,000 to its employees and is currently handing out more than $130,000 a year to about 6,000 people, or six percent of its workers. Hundreds of other companies—including yours perhaps—have similar programs.

Some suggestions are so simple and obvious as to be almost unbelievable. The Westinghouse Transformer Division, in Sharon, Pa., packed its units for export lightly, shipping them to New York to be repacked.

"Let's pack them for export here and eliminate an unnecessary operation," suggested Fred Bennett. He received $1,000—10 percent of the first year's savings.

On the other hand, Alexander McLennan,



Robert Shultz is $454 richer because he thought of a better way of doing his job. He suggested using cotton duck in place of expensive mica in building locomotive motors.

Mike Defino, expert wireman at the East Pittsburgh plant, submits ideas regularly. He has earned enough extra money to pay for a $10,000 house and finance his hobby—bowling.

a repair-shop foreman in Cincinnati, burned the midnight electricity in his kitchen for two years designing and building a transformer-coil unit that would fit all the variously shaped transformer tanks used in residential areas. These devices, used to reduce feeder-line voltage for home use, are returned to Westinghouse for replacement of burned-out coils, and the many shapes made this a costly operation.

McLennan perfected his coil unit, repair time was cut 75 percent—and McLennan was handed a check for $5,000.

With some workers, suggesting becomes a habit—like playing the horses, but more profitable. Edward Brannagan, a group leader in the company's Meter Division, has turned in 1,764 suggestions in 12 years—almost three a week. He bats almost .500, with 843 accepted for a total of $6,827 in cash awards.

The home-workship guy has a natural advantage in the suggestion sweepstakes—a basement knack of finding easier ways to do things is generally taken along with the lunch box to the plant.

Happy is the man who can once outsmart the experts, and Earl Schrum, a workshop whiz who works at the Westinghouse Porcelain Division, did it. A modelmaker, he duplicated in miniature a clay-extruding machine that actually extrudes the standard mix of porcelain clay. He had noticed that the shafts used to form a lengthwise hole in an extruded clay cylinder didn't always hold true, boring the hole at an angle. So he designed a new head for a shaft.

"Sorry," said the engineers, "this doesn't quite add up engineering-wise." Schrum, no man to take "no" for an answer, repaired to his workship and built a couple of heads, took them to the plant, and put them to work. Out came a series of punched holes as true as so many holes in one. "Oops," said the engineers, the suggestion was reconsidered, and Schrum collected.

Weaker Sex Win, Too

Successful suggesting is no male monopoly. Women in industry with a sharp housewifely eye can often detect a "better way" or devise a short cut.

In making fluorescent lamps, the plastic base is held to the glass tube with a tough cement, which sometimes is improperly applied or dries before the parts are joined. To reclaim the bases, the cement had to be laboriously scraped out.

Goldie Roderick at the Fairmont, W. Va., lamp plant, had an idea and took several of the fouled-up bases home. She boiled them and removed the cement with ease. So far, so good. But the boiling took the shiny finish off the bases. A commercial

Earl Schrum, an avid home workshopper, built a scale model of the clay-extruding machine he operated on the job. Then he improved on it, winning the praise of engineers—and cash.

polishing machine would cost $1,000. Then the engineers stepped in. They tried a Westinghouse electric clothes dryer, used white gloves discarded by lamp handlers, and it worked like a charm. They don't scrape out bases any more and Miss Roderick is richer by a couple of hundred dollars.

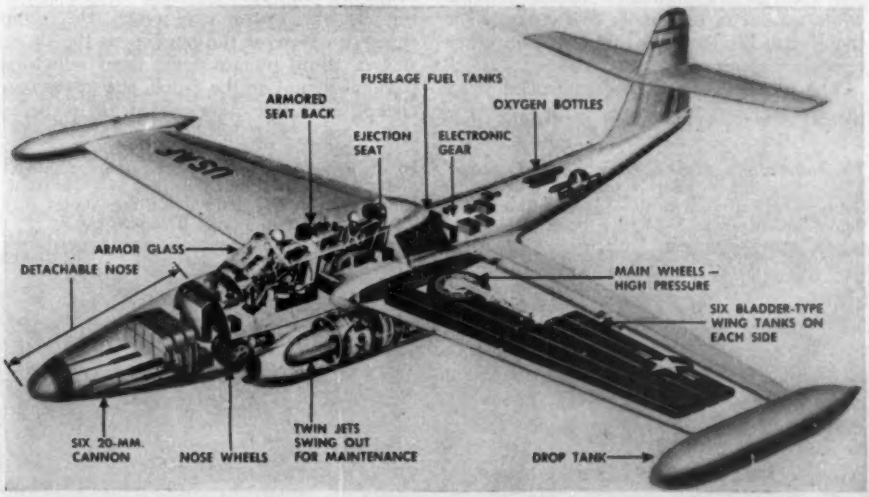
It's never too late to start suggesting, and practice is not necessary to hit the jackpot. Aloysious Estadt had been working for 35 years at the East Pittsburgh plant when he hit on a machine method to replace the hand technique for making mica insulation sheets. It was his first suggestion, it was just 17 words long, and it paid him $5,085.

Westinghouse, which receives about 350 suggestions per 1,000 employees a year, has found them a gold mine. The aggregate saving, for just the period of a year after each suggestion was accepted, was $13,000,000—a substantial sum to even a large company.

But the saving of money is not always the critical factor in suggestion systems. In time of war or national emergency, money is expendable but time is not. Savings are measured on the clock, not the ledger.

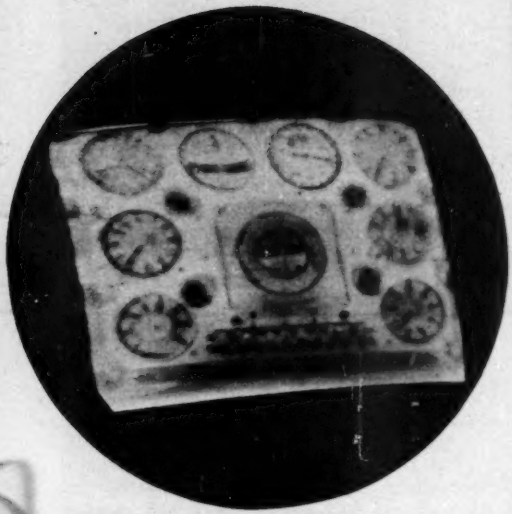
Speed-up suggestions saved millions of man-hours during World War II, and will do so again if we find ourselves in a production race for survival. In one six-month wartime period at Westinghouse, inventions-on-the-job saved 330,000 man-hours. END

First Look Inside the Air Force F-89 Scorpion Fighter



THE cutaway above exposes the innards of the powerful, all-weather interceptor, the Northrop F-89. Radar-equipped, the plane is powered by two Allison J-35 turbojets with afterburners for bursts of extra power. Six 20-mm. cannon and forward armor plate give it fighting punch. The pressurized tandem cockpits have ejection seats. In the 600-m.p.h. speed range, the Scorpion operates at altitudes above 40,000 feet.

TV Takes



On a TV screen in "mother" plane, remote-control pilot sees this image of drone plane's instrument panel. It enables him to fly drone in world's first TV-directed air laboratory.

By Devon Francis

Photos courtesy Grand Rapids Herald

ABOVE an airport in western Michigan an airplane made a perfect bank to the left and then straightened out on course while a pilot in one of its two cockpits sat there with his hands in his lap. The other cockpit was empty.

The plane was a drone, controlled from the ground.

A quarter of a mile away, slightly below the drone and on a parallel course, another plane was flying, its rear cockpit completely shrouded by a black curtain. The occupant of this cockpit was saying through a throat microphone:

"Ground station from mother ship, I've got the drone on my screens. Mother ship taking control at zero. Counting—five, four, three, two, one, zero."

Now the man under the hood in the mother plane was flying the drone plane—by television. All that he could see of the drone was on two TV screens. One pictured the drone's instrument panel; the other showed a view of the horizon as the drone saw it. Both images came from television cameras in and on the drone, one in the rear cockpit and the other sealed to its belly.

TV camera on drone's belly supplies second image for remote pilot—a view of horizon to double-check drone's attitude. Mother and drone planes are obsolete A-24 dive bombers.

In drone's cockpit instrument panel is moved and set up in front of TV camera at lower right. Engine-driven DC generator drives motor that turns converter to supply TV current.

Over Test Pilot's Job

When some fast new fighter is put through its paces, its pilot will be sitting safely miles away—watching a television screen.

Guided by these two images, the pilot in the mother plane had complete control over the drone plane. All the pilot in the drone had to do was sit there, so he could take over in case anything went wrong.

Tried several times in the last few years, remote-control flight by television is at last a reality. By the end of the year, the U. S. Air Force expects to have in operation the world's first television-directed testing laboratory.

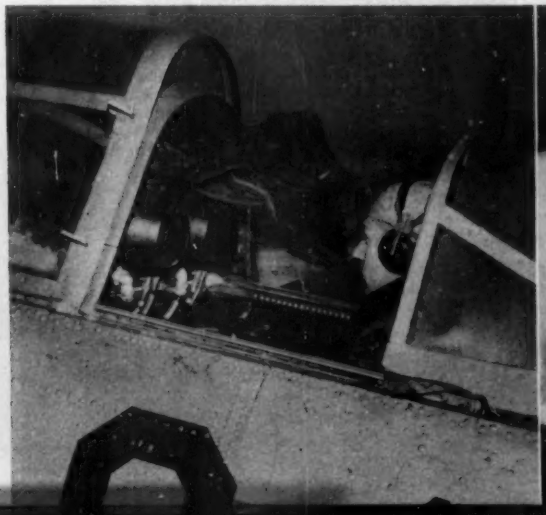
Hereafter it won't be necessary to have a human pilot at the cockpit controls when a swept-wing prototype fighter is put into a terminal-velocity dive or a new bomber is sent aloft to see how it will tote an overload. It won't be necessary to risk a man's life to see how a new type of aircraft reacts to sonic and supersonic speeds.

TV will tell the remote-control pilot, sitting comfortably and safely in another plane several miles away, all he needs to know about the drone's attitude – whether it's climbing, diving, or turning–its air speed, its altitude, the Gs it's being subjected to, the number of revolutions its engine is turning, and so on.

TV will do more. Miles below, at an airport, the same television images will dance on screens in a mobile laboratory to be photographed by a movie camera to keep a permanent record of the flight. Airplane designers can go over these records at their leisure.

Two television transmitters are necessary to the job. The remote-control human test pilot must be able to fly "blind"–to manipulate the drone plane by reading its instru-

In mother plane, remote-control pilot pulls black hood over cockpit to start flight. TV receivers replace usual instrument panel. Temporary TV range of 25 miles will be boosted.



In final version, pilot and co-pilot in remote-control ground station will take drone off ground and land it. Here, co-pilot is at his station in truck with a glass superstructure.

ments when it's out of sight, perhaps at an altitude of 40,000 feet just nosing over into a dive. The second TV installation is just a double-check on the plane's attitude. In effect, it gives the remote human pilot a chance to look past the nose of the drone at the horizon or runway.

Two remote-control cockpits are used. One on the ground takes the plane off and lands it. It's easier to do from the ground. Actual flight maneuvers must be directed from a cockpit in a mother plane. Control from the ground is limited by the short range of TV broadcasting. A mother plane can "carry" a drone anywhere, hundreds of miles from its base if necessary.

Old Trick Gets New Twist

The wedding of television and remote-control flight has taken place after two years of work by the Air Materiel Command at Wright Field, Ohio, and by Lear, Inc., aviation research and manufacturing firm of Grand Rapids, Mich. AMC's Paul W. Nosker did pioneering work for the USAF. Directing the development at Grand Rapids was William P. Lear, the brilliant one-time garage mechanic who last December won aviation's highest award for achievement, the Collier Trophy.

Putting TV cameras and transmitters into an airplane was no new trick. It had been done before (PS, Dec. '45, p. 93). Back in World War II, the Air Force used television in much the same way to crash pilotless, explosive-packed B-17s into the German base at Helgoland. In fact the TV equipment Lear used was made by RCA in 1935.

What had worried the experts was finding a way to make use of the information the television cameras delivered—how to make a remotely controlled, high-speed airplane behave.

By nature, drones are ornery. Most of them have been flown by the radio "beep" method. Radio signals commanded the autopilot to bank or pitch (turn, climb, or dive) the drone. The autopilot, with its conglomeration of gyroscopes, amplifiers, and servomotors, actually controlled the drone—not the remote human pilot. His job was to send the orders to the autopilot.

The basic trouble with that system has been that autopilots don't maneuver a plane the same way manually operated controls do. In banking, for example, the autopilot keeps increasing the angle of bank as long as the bank switch is on. The bank angle depends on the length of time the switch is pressed, not on the *distance* it is moved. With manual controls, on the other hand, the distance you move the stick largely determines how much you bank. Because of this difference, remote pilots find it difficult to stop a maneuver of the drone in a given position—it is always overshooting or undershooting the mark.

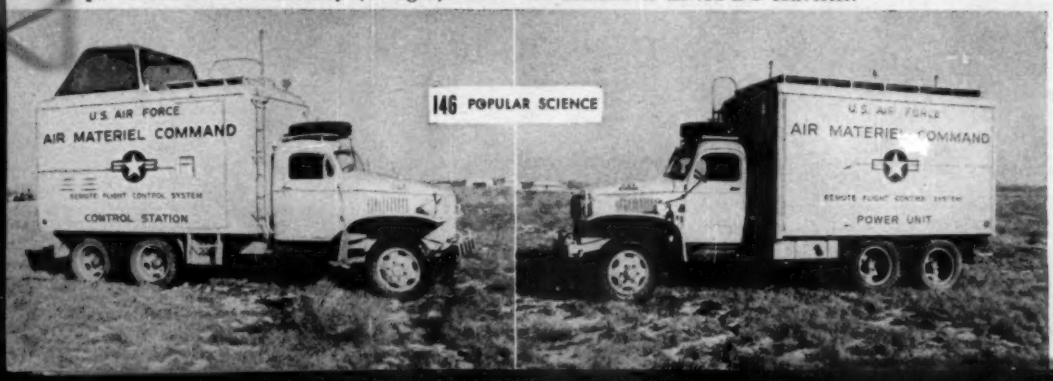
Another difficulty has been that autopilots are designed for ordinary flying. They can't "wring out" a plane, being limited to about 45° in bank and pitch. Aerobatics are an impossibility.

Remote control has now become an asset to test flying since a way has been found to put a drone through any maneuver from remote equipment that works like ordinary controls. A little push on the remote stick makes a little bank, a big push makes a steep bank. The bank angle depends on how far the stick is moved, not on how long it is held over.

The Lear method, a "continuously proportional radio control system," can do just that. It lets a human pilot remotely "fly" the drone with stick and rudders in a normal manner. With television, the elements necessary to perfect remote-control flying are complete. The fact that even a remote pilot

Ground equipment to be delivered to USAF this year will consist of three units—a remote-control station (below) and a truck supplying power and a field laboratory (at right).

Power unit will supply current to ground remote-control truck and laboratory. Each vehicle has storage batteries for temporary use in addition to an AC-DC converter.



gets tired flying has not been forgotten. He can switch over to autopilot control if he wants to stretch his legs.

It would be pleasant to report that the Lear remote-control system is simple. It isn't. It uses a whole batch of complex electronic circuits to perform 35 different functions.

Here's what happens when the remote pilot moves his control stick, say, to the left to bank the drone to the left. His stick is the handle of a potentiometer—a variable resistance. It sets the voltage of an oscillator signal. This signal, its voltage now proportional to the amount of bank the pilot wants, is broadcast to the drone. There a receiver picks it up, amplifies it, and feeds it to a servo-motor that moves the ailerons on the drone. And the drone banks to the left. How much the servo-motor moves the ailerons depends on the voltage of the signal, which in turn depends on how far the remote-control stick was moved.

Control System Has 35 Jobs

But the control system has to do a lot more than move ailerons. It may be called on to move cowl flaps, fuel valves, wing flaps, dive flaps, landing gear, change propeller pitch, and many other things—35 in all.

One radio beam handles the lot. It has nine separate sub-carriers, which are mixed together in the remote transmitter and unscrambled by band-pass filters in the drone receiver—like oranges being graded according to size in a packing plant.

Nine sub-carriers still aren't enough. Some must do multiple duty if 35 tasks are to be performed. Four have individual jobs, being assigned to work the throttle, ailerons, elevators, and rudder. The rest of the "piloting" is divided between two sub-carriers. One of these handles on-off or up-down switching, such as raising or lowering the landing gear and turning the autopilot on or off. The other governs a dozen secondary, proportional controls, moving levers in the drone to just the desired position. To route the signals from these multiple-duty sub-carriers to the proper control requires two more sub-carriers, which serve as a "switchboard." Called "positioners," they enable the human pilot to select the function he wants performed. Thus, the positioners would connect sub-carrier No. 8 to the landing-gear servo so that the signal from sub-carrier No. 8 could lower the landing gear.

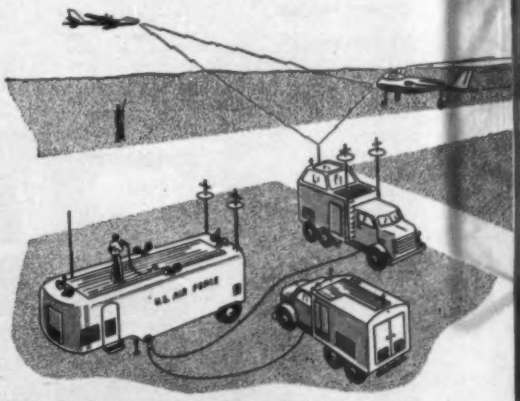
In this way the remote pilot punches buttons to make a few sub-carriers do many different things, shunting the work around the radio beam the way a railroad towerman switches trains around a yard.

There's still one sub-carrier left. That is used for a steady reference signal. By comparing the incoming control signals, which have varying and unknown voltages, with this steady signal of known voltage, circuits in the drone can correct the control signals for any loss in signal strength.

Even with amplifiers and correction circuits, radio signals may weaken to the point where they won't do any work at all, so a safety device is added to make the autopilot take over the drone and cut off the radio receiving system in its entirety.

All this is done with just the nine sub-carriers riding one radio beam. Of course, there are also two other channels for the TV

Laboratory is partitioned into a radio and recording room, a darkroom to develop pictures, and a machine shop. All three vehicles are air-conditioned for desert or arctic operation.



This is how system ultimately will operate. Prototype system uses 4,897 kc. for communication, 256 mc. for TV instrument camera, 288 mc. for horizon camera, 71.5 mc. to fly drone.

transmitters plus one for communication.

The work on the TV-remote-control flight system isn't all beer and skittles for the engineers and engineer-pilots involved. The remote-control pilot in the mother ship has a hard time making his hands and feet turn the drone plane left at the same time his own plane is turning left. His impulse is to correct for seat-of-his-pants feelings of the mother-ship motions. That would make the drone do the opposite of whatever the mother plane was doing.

There is a noticeable lag—something less than a second—between movement of a control in the remote cockpit and a response in the drone. That will be reduced in the final version of the system. Right now, though, the remote pilot has to "fly ahead of" the drone—anticipate its movements, especially in rough air.

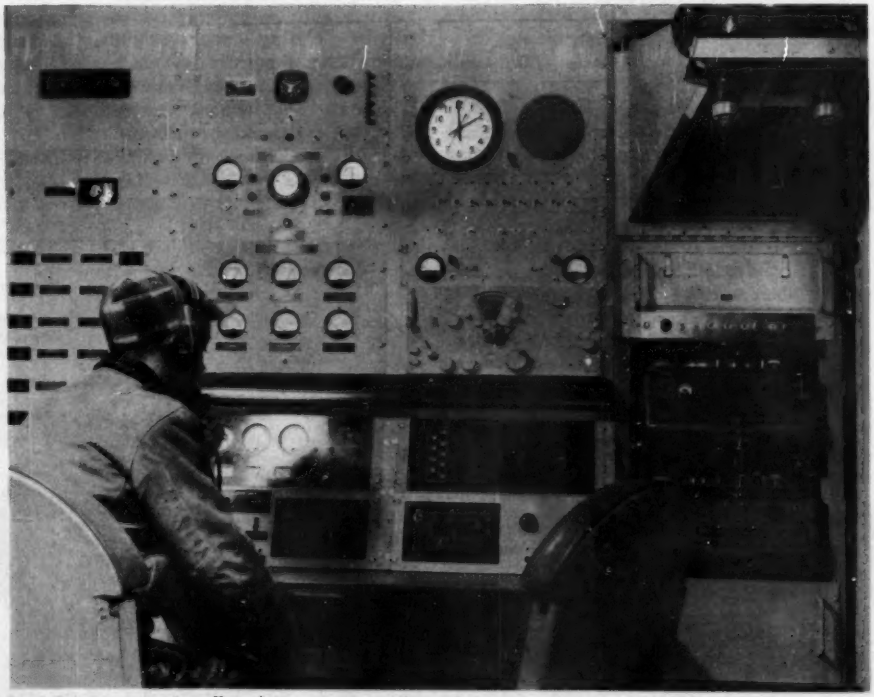
The lag makes an inexperienced pilot overcontrol the drone. The safety pilot, who has been riding the drone throughout the experimental period, gets a somewhat erratic flight, and he complains endlessly on his channel to the remote-control pilot.

And then, inevitably, things happen. One day the drone lost its receiving antenna while it and the mother plane were above clouds. Released from remote control, it promptly went into a screaming dive. The human pilot aboard grabbed everything he could lay his hands on and pulled the plane into level flight as it broke through the cloud bank.

The remote pilot in the mother plane, watching the drone's instruments go haywire and the horizon roll upward on his television screens, barked to the pilot up front. Down spiraled the mother plane through the clouds.

Everybody was wet with sweat before things were under control again.

Designed for the precise and meticulous job of airplane testing, the TV-equipped drone nonetheless offers some nonscientific sightseeing. As it maneuvers to land, it frequently affords groundlings back at the base a perfect air view of downtown Grand Rapids, not far from the airport. END



In laboratory unit, all radio messages, telemetering data, and TV images will be recorded by magnetic tape and movie cameras. Technicians will monitor tests on auxiliary equipment.

Cargo Conveyor Zippers Up

THE snakelike conveyor belt coiling around this page swallows large quantities of porcelain pellets on one floor, then spews them out on an upper story. A zipper added to the flexible sidewalls of an endless belt makes it possible for the Coors Porcelain Co., of Golden, Colorado, to transport such fragile pieces to storage bins without breakage. As shown in the drawings, roller-bearing guide rollers automatically open and close the zipper teeth at any predetermined feed or discharge point along the conveyor line.

The Closed-Belt Conveyor-Elevator can handle bulk foods, chemicals, coal, or other granular materials without spillage, leaking, or internal shifting at the rate of 840 cubic feet an hour. The track can be routed around obstructions and the belt moves at speeds up to 200 feet a minute. Stephens-Adamson Co., Aurora, Ill., designed it.

Cross section of closed belt shows contents tightly encased. Material does not spill or shift around inside while belt travels.

Four fixed ball-bearing rollers automatically spread belt, mesh teeth, and lock them shut as belt passes closing station.

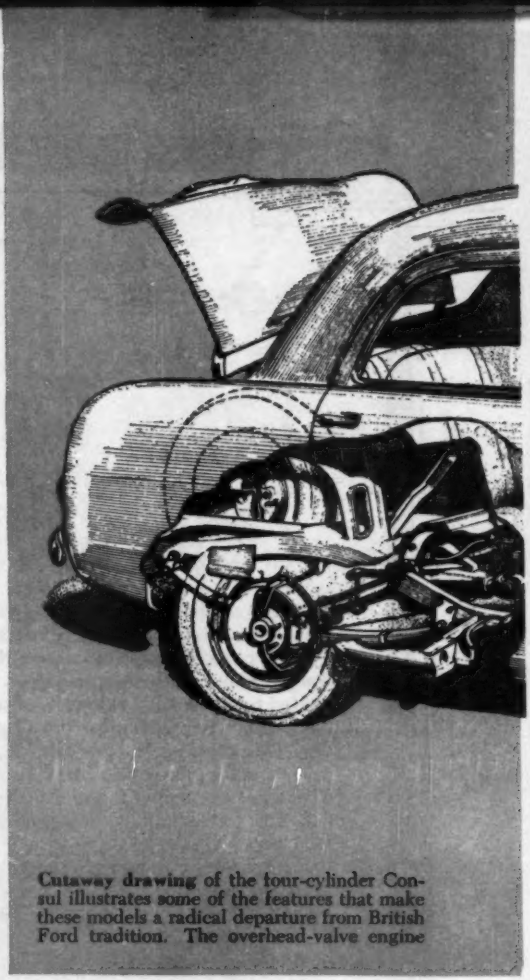
Loading area has large idler roller that opens belt flat for cleaning. Past this point flexible hinged walls rise to receive materials from feed hoppers. Four steel rollers then close zipper.

British Fords Get U.S. Look

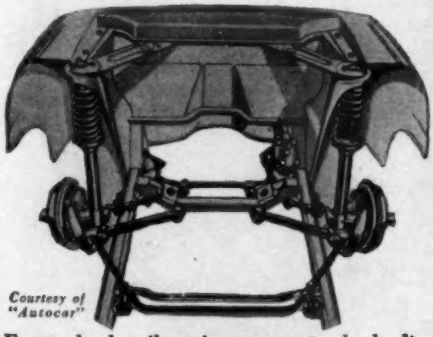
YOU have to look twice to tell these two new British Fords from their larger American counterparts. In contrast with the strictly utilitarian Prefect and Anglia, the sleek new models mark British Ford's first approach toward big-car styling and performance, even though they're still on the small side.

The bigger of the two, the Zephyr Six, is the first six-cylinder automobile built by Ford in Britain. Both the Zephyr and the smaller four-cylinder Consul break a 40-year tradition in British Ford manufacture by using overhead valves operated by pushrods. The engines have a bore of 3.125 inches that, coupled with a stroke of only three inches, allows bigger valves and added power. Both engines have a compression ratio of 6.8 to 1.

Floorboard drafts have been eliminated by hanging the brake and clutch pedals from behind the dash. Both brakes and clutch are hydraulically operated, each with its own master cylinder fed from a common reservoir.



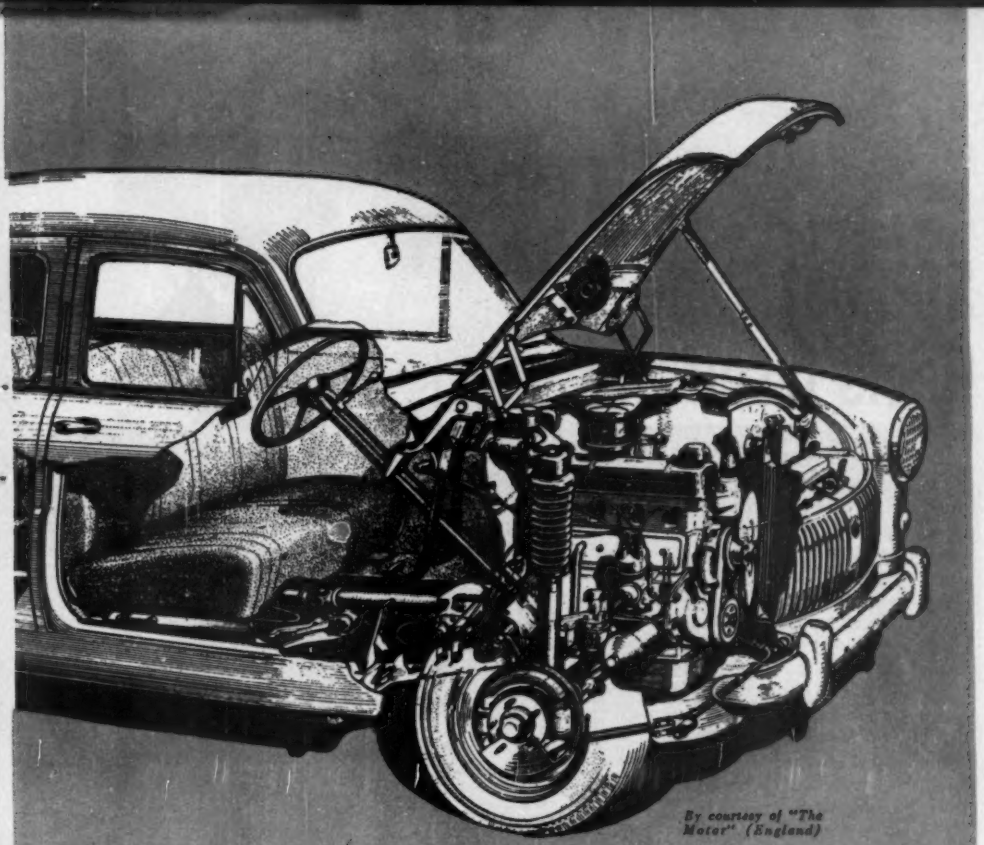
Cutaway drawing of the four-cylinder Consul illustrates some of the features that make these models a radical departure from British Ford tradition. The overhead-valve engine



Courtesy of "Autocar"

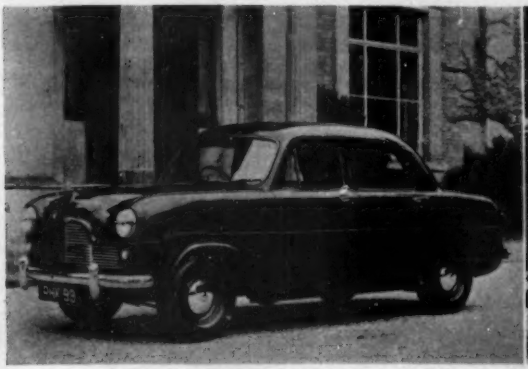
Front-wheel coil springs support wheels directly and pivot with them. Springs encircle telescoping guide rods that keep wheels upright and also serve as double-acting shock absorbers.

Except for the grille, this four-cylinder 47-hp. Consul could almost pass for its American cousin. It's easy on gas, giving an estimated 25 m.p.g., has top speed of better than 70 m.p.h.



By courtesy of "The Motor" (England)

is new, as is the independent front-wheel suspension system. The clutch, as well as the brakes, is hydraulically operated. This allows both pedals to be hung from behind the dash, instead of coming up through the floorboard. The back seat is well forward of the rear axle for greater riding comfort. Road clearance is just under seven inches.



Zephyr Six has slightly longer wheelbase and hood to accommodate six-cylinder engine. Inside body dimensions are identical. Six develops 68 hp., will do over 80 m.p.h., gives 21 m.p.g.

Cars are low and wide, three inches wider than high. Interiors are surprisingly roomy, with plenty of leg and head space. Note the American type of recessed, step-down floor.

50-Foot Tape Reels Itself In

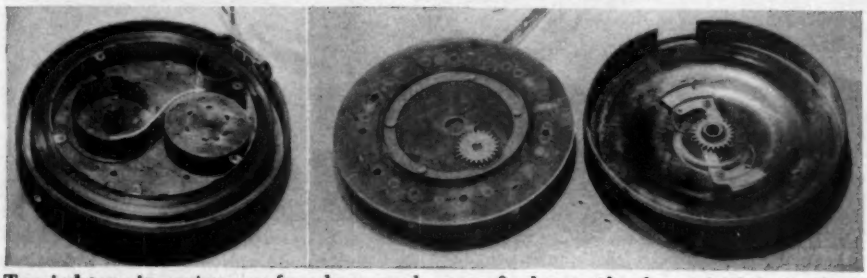
YOU don't have to fuss with a hand crank to reel in this new 50-foot steel tape measure—it reels itself in. Until now, automatic tapes of this length have been impractical because the spring would have to be too big. And because an ordinary spiral spring "runs down," it pulls too hard at the beginning, not hard enough at the end.

The secret of the new tape is a constant-tension spring called the Neg'ator (PS, Nov. '49, p. 170). This is a flat, steel ribbon that's prestressed so it curls up into a small, tight coil. If you wind the spring onto a large spool, it tries so hard to curl up again that it will run right off the big spool and coil around a small one.

That's just what happens in the tape measure. Inside the tape reel are two spools, a small one that holds the spring and a bigger empty one. As the tape is pulled out, the rotation of the reel winds the spring onto the large spool through gears. Then, when the brake is released, the spring runs back to the small spool, rotating the reel the opposite way and winding in the tape.

Because the spring is evenly prestressed throughout its length, it always exerts the same pull. The Master Rule Mfg. Co., Middletown, N. Y., sells the tape for $12.

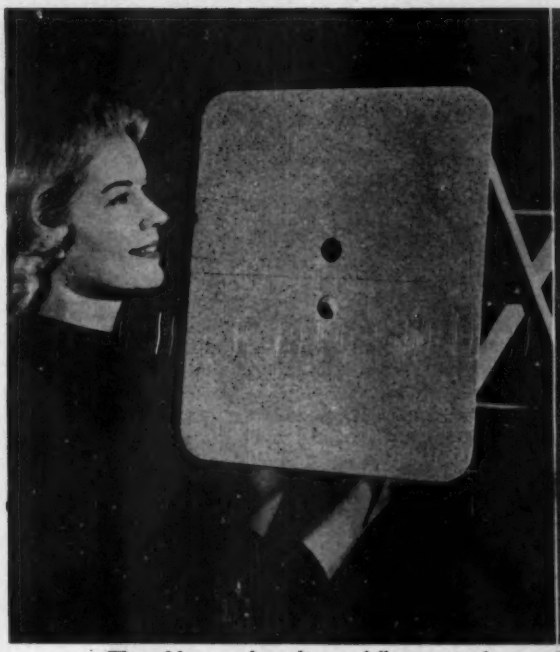
Too big a load for an ordinary spring, this 50-foot engineer's tape measure is easily reeled in by constant-tension spring that pulls as hard on the last foot reeled in as on the first.



To wind tape in, spring runs from large spool back onto small one (arrow, above). As large spool turns, it rotates planetary gear on outside of drum (center) that revolves around sun gear fixed to inside of case (right). As planetary gear revolves, it forces tape drum to turn with it, winding tape in. Ring on drum is brake band that rotates between shoes on case.

New Paints include such finishes as multicolor enamels, rubber-and-water paints, and brush-on coatings that look like suede.

By George H. Waltz, Jr.



The old gag of sending a fall guy out for a can of spotted paint won't work any more. A new enamel, called MultaColor, is just that. It makes it possible to apply a combination of from two to five colors to surfaces with one brushing, spraying, or dipping operation.

THIS year, as spring and the painting season roll around again, paint users will find an unusually large variety of new and revolutionary paints and finishing processes available. Many of them have been developed especially to make the amateur handy man's job easier and to make the finished job look more like a professional's.

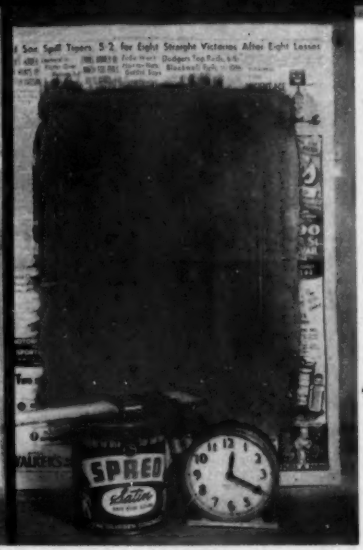
Probably the most dramatic recent development to make the jump from the paint-research laboratories to the shelves of your neighborhood paint and hardware stores is the perfection of the so-called rubber-base paints. It is dramatic because the formula for the rubber paints breaks a long-standing precedent in paint making.

For years, most conventional paints have consisted of pigments, oil, or varnish, and mineral solvents or turpentine. Such paints dry by a combination of chemical reactions that require considerable time. Also, since the solvents used are apt to have strong odors, a room painted with most conventional paints may retain its "new-paint" smell for some time.

The rubber-base paints, on the other

Rubber-base paint, Spred Satin, dries quickly. In the photo above, letter S has been brushed on a dry paint surface.

Ten minutes later, the fresh Spred Satin was partially dry and had begun to blend into the previous coat of paint.

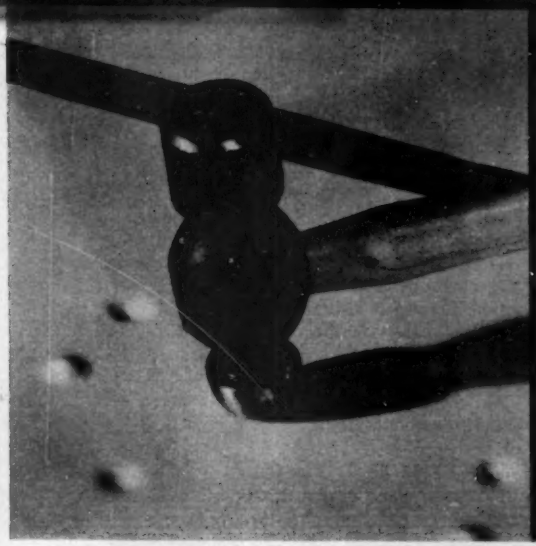


In 20 minutes, the painted S was dry to the touch and had blended in completely. No brush marks were visible.

hand, consist of pigments, synthetic rubber emulsified in water, and chemicals and colloidal matter. Because they dry by the evaporation of the water rather than by any chemical process they dry quickly. Also, since water is used as the carrier, the odor of a solvent is eliminated.

Although the actual ingredients and the step-by-step process used in manufacturing the rubber-base paints are still trade secrets, it is known that the paint is made by whipping up a mixture of sub-microscopic particles of synthetic butadiene-styrene rubber (similar to that used in auto tires) and water until it forms an emulsion that can be colored. When the paint is brushed on a wall or similar surface and the water evaporates, the tiny rubber particles join to form

New paint sandwich protects Westinghouse transformers. Both units above were subjected to 1,000 hours of salt-water spray. One at left, protected by new mica paint, was unharmed.



Because rubber-base paints contain synthetic rubber in an emulsified form, they are elastic and flexible. As shown in test above, they will not chip or crack when dented.

Although ordinary water is used as the carrier in rubber-base paints, they are extremely waterproof. Paper, above, coated with Spred Satin and allowed to dry, holds water.

a thin film, or sheet, that clings to the surface.

An excellent example of the rubber-emulsion-type paints (at last count some half-dozen paint companies were in production, with others in the development stage) is Spred Satin, put out by the Glidden Co. The results of rigid tests show that Spred Satin goes on easily, covers well when applied to wallboard, plaster, wood, and even wallpaper, is washable and waterproof; and it is said not to crack or chip when dented. Quick-drying and odorless, it makes possible the use of a room one hour after it has been painted.

According to Glidden experts, the new rubber-water emulsion paints are so radically different from conventional paints that they have opened a new field of paint research. With this in mind, Glidden is completing a new laboratory near their plant in Cleveland that will be devoted exclusively to rubber-emulsion and related research.

"Polka-Dotted" Paints

Want multicolored walls in your home without the tedious, time-consuming chore of stippling on additional coats? The United Lacquer Manufacturing Corp., of Linden, N. J., has the answer for you in their Multa-Color. In bulk, this enamel looks like a homogeneous mass of colored specks. When applied, it dries to a uniformly distributed stippled or "broken-effect" finish.

Available in flat, semi-gloss, and gloss, the one-coat paint can be had in any one of 16 standard color combinations. Because it requires no priming coat, except on metal, it is particularly suited for use on composition board, wallboard, wood, and plaster.

Thinning Lacquer by Heat

Another brand-new entry in the finishing industry is the hot-spray lacquer process. It, like the process used in manufacturing the rubber-base paints, also breaks away from long-standing custom. Until recently, the viscosity, or thickness, of lacquers used for spraying was reduced to the proper flow consistency by the addition of quantities of lacquer thinner. The hot-spray process accomplishes the same result by the use of heat.

The lacquer is heated to a temperature of about 160° F. before it reaches the nozzle of the spray gun. Various types of electric and steam heaters are available to do the job. In some, the lacquer is continuously heated as it flows to the spray gun. In simpler, less expensive versions, spray-gun jars filled with lacquer are heated and used as required. Because more lacquer can be applied with less thinner, fewer coats are required for the same thickness of finish, cutting material and labor costs.

Much of the development work on this process has been carried on in the laboratories of the Hercules Powder Co., in Wil-

Lacquer is sprayed on hot in new finishing process. Heating the lacquer to 160° F. makes it possible to reduce the amount of solvent required and to get better coverage.

Different types of lacquer heaters can be used. In the hot-spray setup shown above, cups containing lacquer are heated in unit on the table and are attached to spray gun as needed.

Coin placed on dry hot-spray finish shows absence of ripples, or "orange-peel" effect, and also the high gloss that can be obtained. Hot spraying cuts finishing costs considerably.

mington, Del. As this is written, a fleet of both old and new cars, all wearing hot-lacquer coats, are providing Hercules engineers with a mobile proving ground.

Durability is a vital quality in any finish, but it is particularly important in paints designed to protect metal surfaces, such as the casings for the pole transformers that bring us our home electricity. They must be able to take Nature's roughest weather. Westinghouse researchers have solved the problem with a novel triple-decker "sandwich" of paint. First a priming coat is applied, then a middle layer made up of flakes of mica embedded in a thick liquid plastic, and finally a finish coat. Tests made under all kinds of weather conditions show that the new paint sandwich is so durable that it will more than double the life of transformer finishes.

And speaking of durability, there's a new enamel for radiators. It comes in a range of colors and is said to retain its color regardless of heat and not chip or peel. There also are a variety of new durable finishes for cellar and porch floors, window trim, and trellises, as well as a nonskid paint for cement terraces and floors.

Special-Purpose Paints

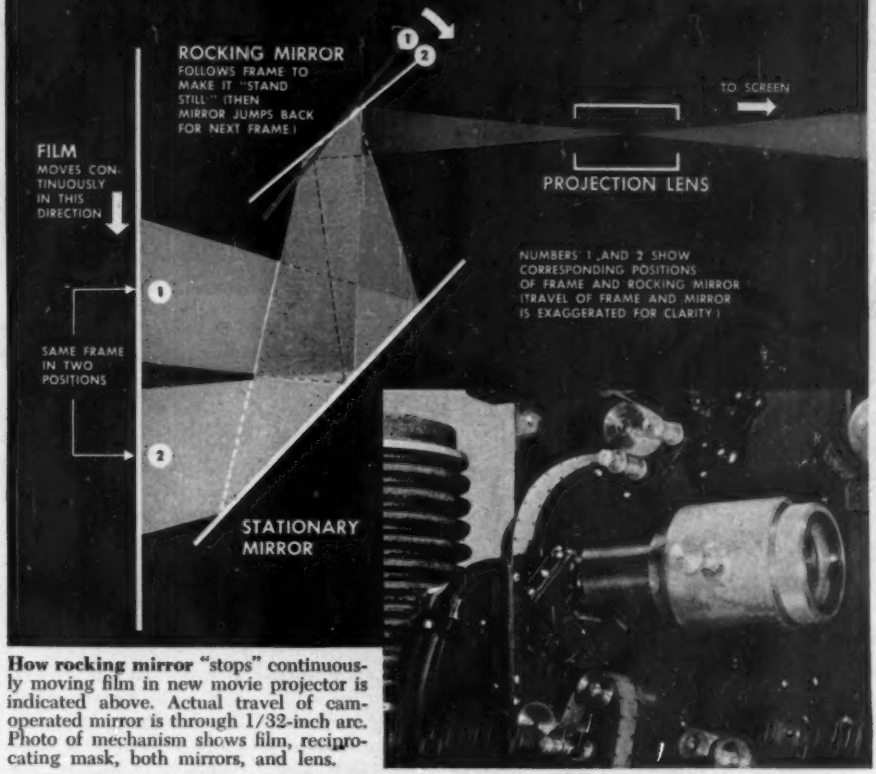
Two other recently announced finishes are designed to look like what they "ain't." One is a synthetic-rubber wall paint that when brushed on and allowed to dry, looks like colored suede. The other is an enamel, called Un-i-loid, that gives a hand-hammered look when sprayed on metal objects.

If, in the interest of privacy, you'd like to frost over a clear-glass window in your house, you can even buy a paint to do that. It comes in a wide variety of colors and can be applied with a brush.

You name a paint for a purpose, and the chances are that the paint industry either already has such a paint or is busy at work developing one. END

Chemical Kills Tree Roots in Sewers

AFTER several years of tests, the Michigan Forestry Department recommends copper sulphate to kill tree roots that clog sewer connections in residential areas. They suggest that five pounds of copper sulphate crystals be placed once a month in the "clean-out" entrance into the sewer until a free flow is obtained. Once cleared, four one-pound applications a year should keep the connections clear of roots.



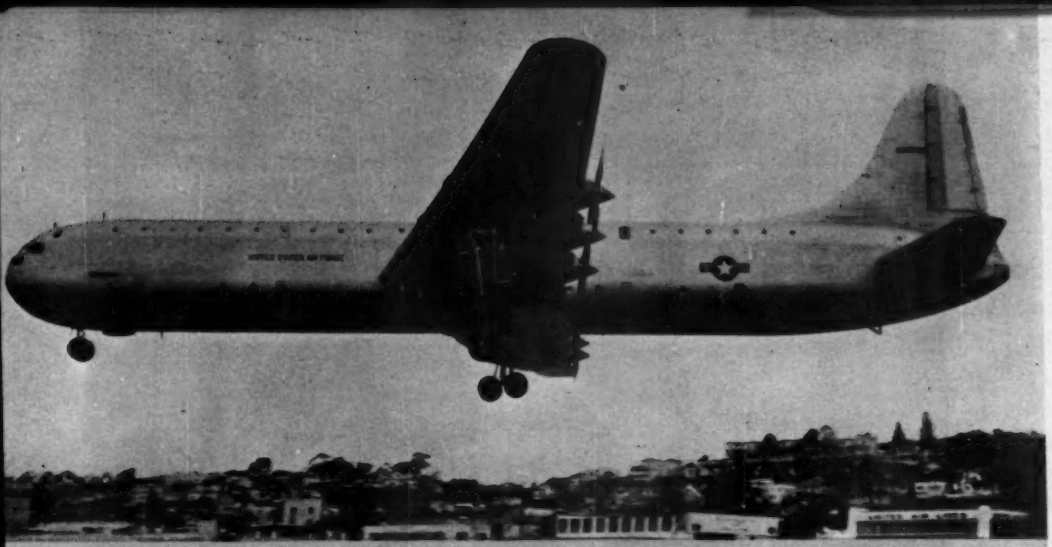
How rocking mirror "stops" continuously moving film in new movie projector is indicated above. Actual travel of cam-operated mirror is through 1/32-inch arc. Photo of mechanism shows film, reciprocating mask, both mirrors, and lens.

New movie projector is demonstrated in action. Film runs nonstop through machine, from reel at top to reel at lower right. Eliminating stop-go motion saves wear and tear on the film.

Movies Projected From Nonstop Film

FILM runs without stopping through a movie projector devised by John R. Hearst, of El Monte, Calif. It throws a brighter picture on the screen than does the conventional kind, he declares, and spares the film from wear and tear.

In a standard projector, film starts and stops 24 times a second, and is locked stationary while each frame appears on the screen. The film in the new projector keeps moving, but a rocking mirror holds each frame steady and blurless on the screen. A reciprocating mask (omitted from the diagram for simplicity) also moves in synchronism with the frame. During the blacked-out period created by a revolving shutter, mirror and mask jump back for the next frame. This return movement takes only 1/12 of the complete cycle. Each frame is displayed longer than usual, the screen is dark a shorter time, and better illumination results.



Champion aerial weight-lifter, the XC-99 can tote 50-ton payloads at speeds over 300 m.p.h.

Biggest Air Freighter

THE world's largest land plane has joined the war effort. Currently undergoing weight-lifting tests by the Air Force, the huge, experimental XC-99 is also making itself useful by ferrying critically needed military supplies to coastal jump-off points.

On one test hop it lugged 50 tons of aircraft parts from California to Texas—more cargo than could be carried by 20 C-47s. Later, it dashed nonstop from California to Georgia with 42½ tons—largest transcontinental payload ever carried.

Big sister to the A-bomb-toting B-36, the mammoth Convair cargo plane has the same 230-foot wingspan, but is 20 feet longer and 11 higher. Its twin decks have a total cargo capacity of 30,000 cubic feet—as much as 10 railroad boxcars. Powered hoists at two giant hatches, fore and aft of the wing, haul in cargo that wouldn't fit into

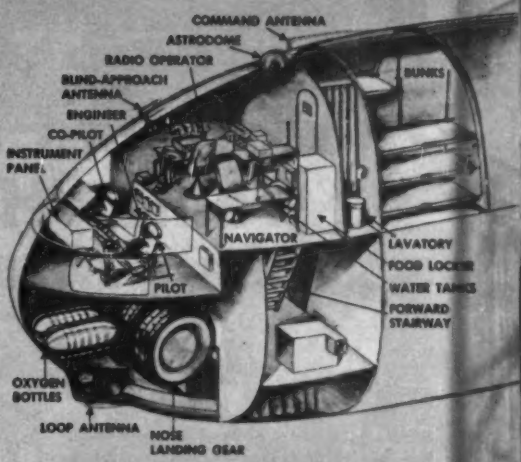
Mammoth air freighter is 182¾ ft. long, 57½ ft. high. Six pusher-type, 3,500-hp. engines develop 21,000 hp. Maximum range is about 8,100 miles. Note twin, four-wheel main landing gear to support plane's 150-ton weight when loaded.

Powered hoists haul large, heavy cargo aboard XC-99 through two big hatches like one above.

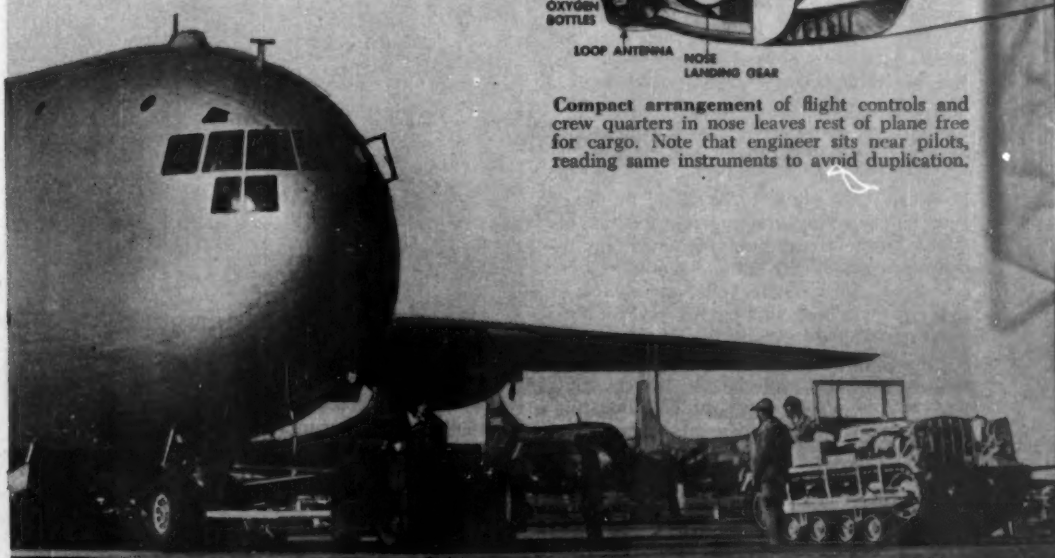
Goes to War

another plane. With ramps in place, jeeps, trucks, and heavy guns can be rolled right in. Inside, cargo is speedily stowed by monorails that run the full length of both decks.

As a troop transport, the plane can carry 400 fully equipped soldiers or 305 litter patients. The U. S. Post Office is also eyeing the giant as a possible mail carrier. Besides toting 50 tons at a clip, it could provide full facilities for sorting mail en route.



Compact arrangement of flight controls and crew quarters in nose leaves rest of plane free for cargo. Note that engineer sits near pilots, reading same instruments to avoid duplication.

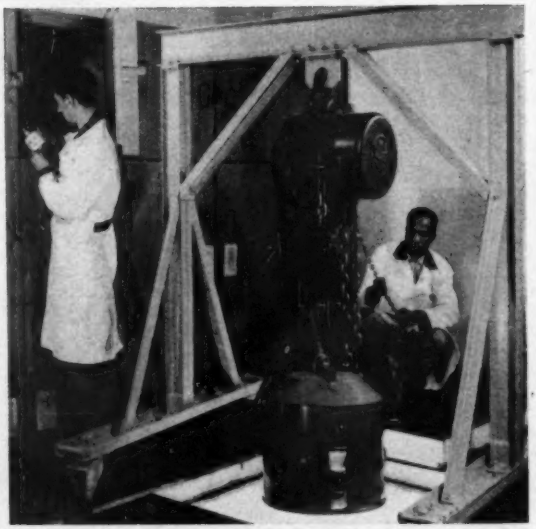


Man at control console runs the mighty Brookhaven pile. Assistant checks wall instruments.

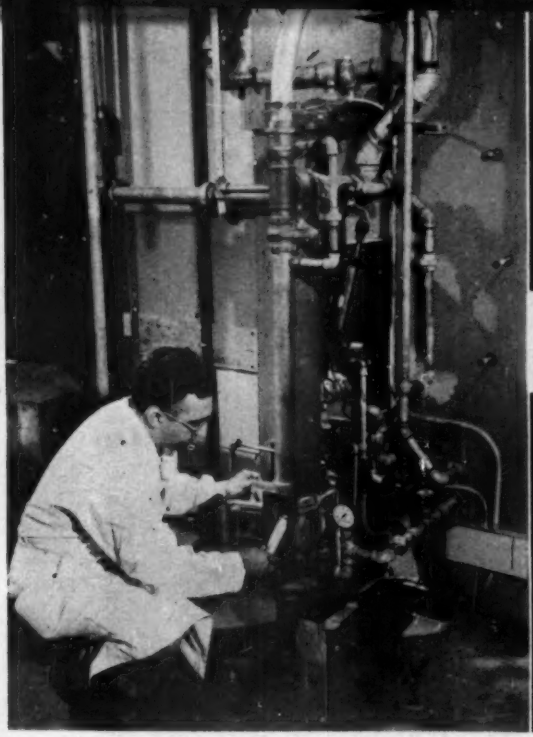
How Atom-Pile Men Tame "Hottest" Stuff

AS PERILOUS as a misstep by a lion-tamer would be any carelessness by the men who handle atomic-pile products at Brookhaven National Laboratory, Upton, N. Y. Behind massive barricades of concrete and stainless steel, they cage the most dangerous of radioactive chemicals, and use them in "hot" experiments watched through periscopes. How it's done is revealed in an unusual behind-the-scenes series of photographs released by the atomic research center. The pictures include the first photo to be made public of the chain-reacting uranium pile itself. This "inner sanctum" can be approached only by those entrusted with atomic secrets.

Brookhaven's mighty pile, unlike others making plutonium for atom bombs, has been designed especially for research (PS, Apr., '49, p. 121). Among the many problems that experimenters are investigating with its aid are methods of concentrating radioactive wastes for disposal, better structural metals for use in atomic piles, and effects of radiation on bacteria and viruses.



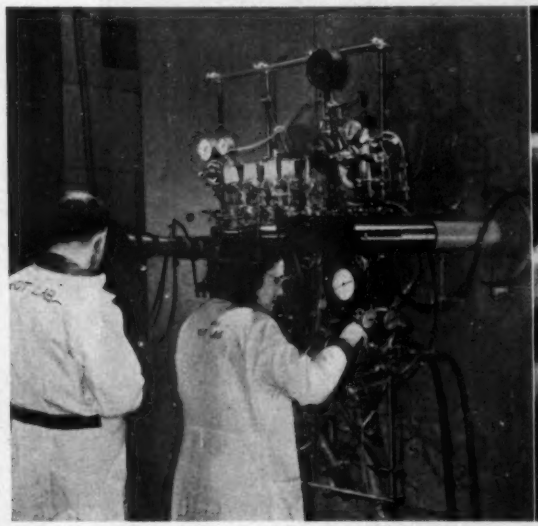
Lead "pig," caging rays of intensely radioactive material inside, is lowered into storage well to await future use of contents. Thick concrete slab will cover opening above well.



Pneumatic-tube system rushes short-lived radioactive chemicals at 40 miles an hour from pile to experimenters. In this picture, container is being inserted in tube outside the pile.

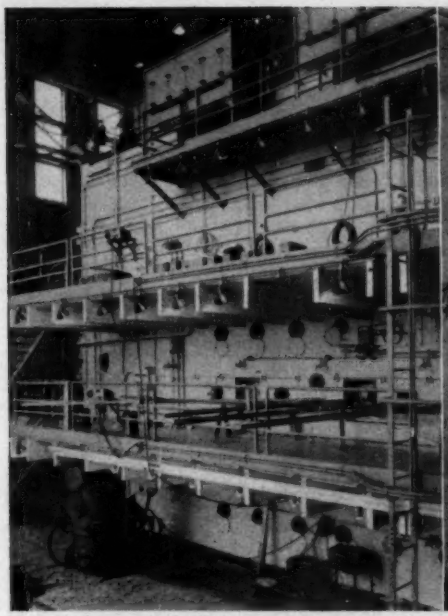
Container used in Brookhaven pneumatic-tube system for delivering chemicals of short radioactive life resembles type that brings change in stores. Workers call it a "rabbit."

Thimble, closed by cap, holds radioactive material and rides in "rabbit." It can be set in place for test from safe distance. This one is empty, or it would not be handled so freely.

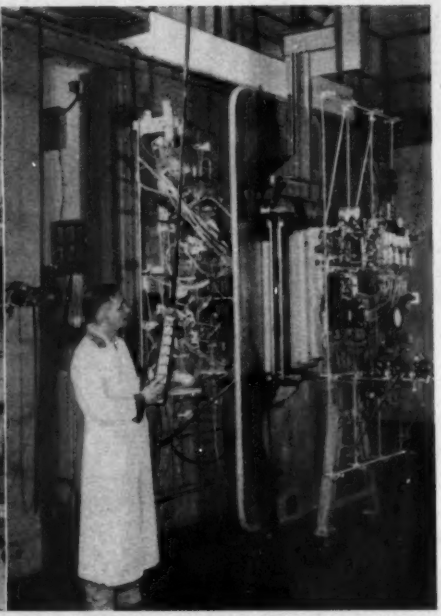


"Hot cell," one of three, enables workers outside yard-thick concrete walls to experiment with most dangerous of radioactive materials within, using periscopes and remote controls.

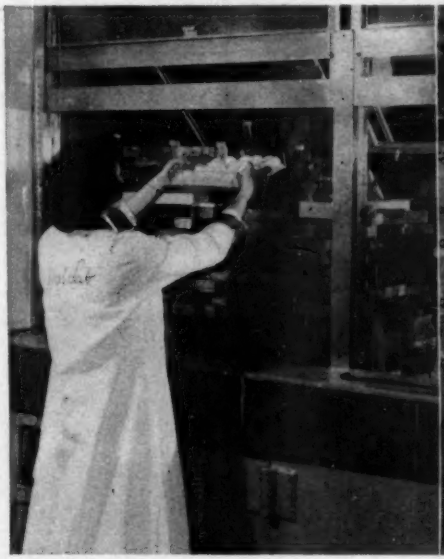
Actual view through periscope shows apparatus set up for experiment in "hot cell." Vessel holds uranium solution while infrared lamps below heat it. [*Turn the page.*]



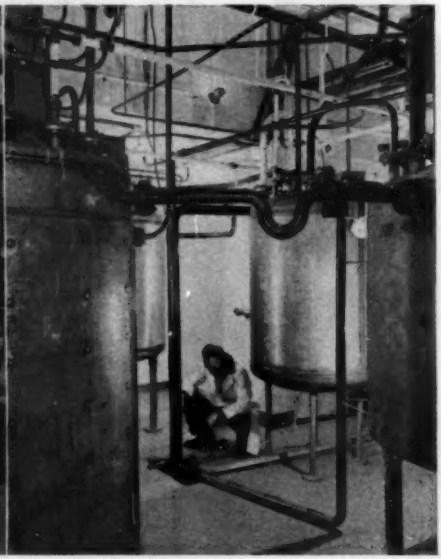
First photo of Brookhaven pile made public shows its west "working face." Windows allow materials to be inserted for irradiation, and rays to emerge for experiments outside pile.



Mobile panel of chemical apparatus rolls into "hot cell" for use, and out again for decontamination. Massive 11-ton steel door of cell silently slides open or shut at flick of switch.



To test rays' effect on germs, technician places virus-injected eggs behind protective wall of lead bricks in "hot cave," and raises radioactive source into "cave" by remote control.



Underground tanks hold "hot" liquids from experiments until radioactivity dies down. When tanks are filled, no one can enter this room. Periscopes permit inspection from room above.

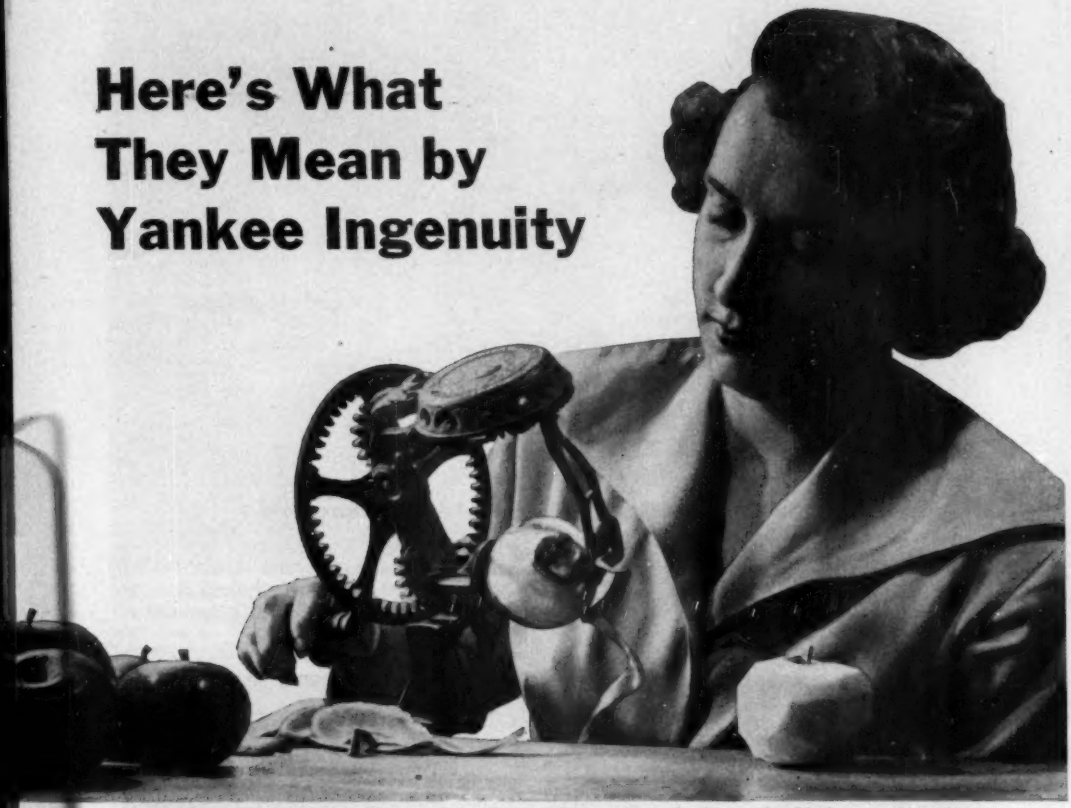
Lightplane with Tricycle Gear Is Simple to Land and Fly

LANDINGS and take-offs are easy with the four-passenger Tri-Pacer, first of the famous Piper lightplanes to be supplied with tricycle landing gear. On the ground, rudder pedals work the steerable nose wheel. Rudder and ailerons, interconnected to simplify coordination, operate from a single control in normal flight. They are linked through springs, and may still be used independently, as when landing.

Photo Reveals Inside Story of a Big Glass Furnace

RESEMBLING a mine of giant gems, this scene is the interior of a big glass furnace in a Westinghouse fluorescent-lamp plant at Fairmont, W. Va. The man in the picture is breaking away solidified glass to permit maintenance work on furnace walls. The furnace is shut down every 30 months to do this; in between it makes enough glass for a tube about 60,000 miles long. The furnace holds 120 tons of molten glass at 2,750° F. Sand, limestone, feldspar, and arsenic are the raw materials fed into it.

Here's What They Mean by Yankee Ingenuity



This cast-iron apple peeler of 1750 did a fine job of undressing an apple. Still does. The apple revolves slowly as the blade moves in the opposite direction.

Musical mousetrap entertains at the expense of a trapped rodent, who turns drum and smaller cylinder with metal pins. These hit levers that tap out a tune—Three Blind Mice.

Corn-kernel remover looks more like a medieval torture instrument. A cob, fed into side hole, has kernels neatly clipped off by sharp knobs on a turning metal plate.

Carpet sweeper of yesteryear looks a good deal like a present-day one. But the brushes that pick up dirt in the box on the floor have to be turned by the large hand crank.

This is a butter churner, made entirely of wood, including the gears. When it is set over a tub, the paddles are revolved at a high speed by turning the hand crank.

THAT "Yankee ingenuity" wasn't just an idle phrase is proved by the existence of the clever labor-saving gadgets pictured on these pages. They were used by the up-to-date New England housewife of 100 and more years ago in keeping her home running.

Collected from the shelves of long-vanished general stores throughout Massachusetts, the implements form part of a folk museum in one of the restored 18th century buildings at Old Sturbridge Village.

While most of the wooden and iron devices seem primitive by our modern stainless-steel standards, they incorporate ingenious mechanical movements still in use in the slickest modern counterparts. END

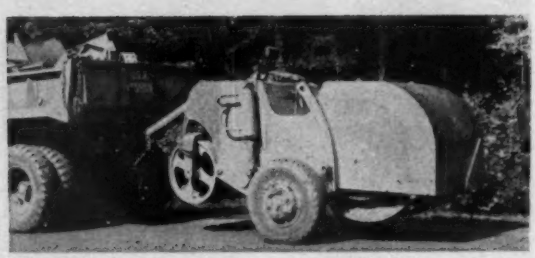
Not a destructive mortar shell, but an old-fashioned chestnut roaster. When it is placed on the top of a stove, popping husks are held safely within the revolving iron sphere.

Open view of a meat grinder, below, shows ingenious spiral arrangement of wooden knobs on a central roller that carries chunks of meat against metal blades for quick shredding.

New Army Building Machines Go By Air

EVEN bulldozers, road scrapers, and rollers can fly to the fighting fronts now. Ingenious design tricks have led to new construction machines that are tough, yet light and small enough to fit in an airplane.

While some are standard commercial machines, others have been specially designed. A tractor-'dozer, for example, combines the frame of a small tractor, the gas tank from a smaller one, the track system from a middle-sized one, and a new type of hydraulically operated blade. To make up for its light weight—weight helps a bulldozer do its job—this one runs twice as fast as ordinary machines. Even so, early models sometimes rode up over hard earth on excavations. Then a Corps of Engineers researcher suggested putting teeth on the bottom of the blade. The teeth break up the hard earth when the 'dozer moves back, loosening it for easier removal.



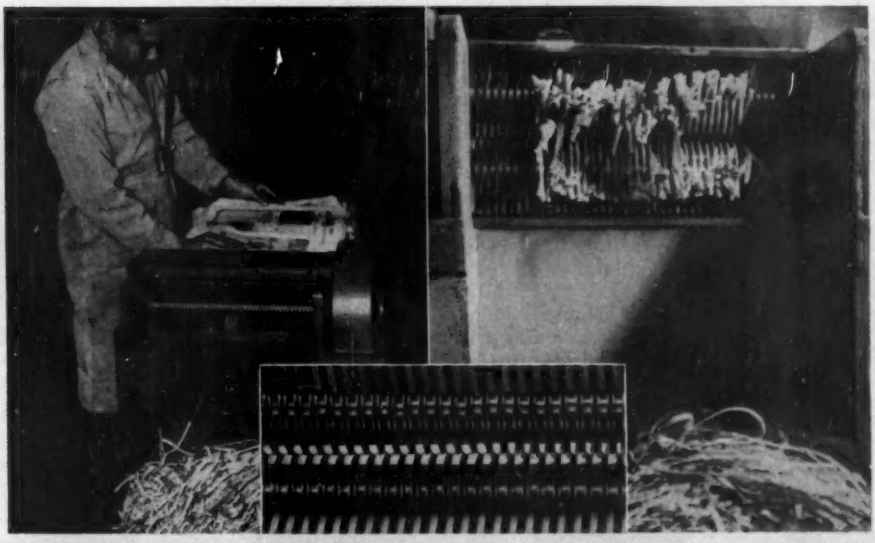
This road roller can get to a new job fast. Light enough to be carried in an airplane, it also has retractable rubber-tired wheels so it can be towed on existing roads at high speed.

The big fenders on the airborne tractor above are hollow—they can be filled with sand ballast to give added traction when the machine is working. The scraper behind also fits in a plane.

The Army's big power saw—also meant for air transport—is designed for clearing land. But it can double as a sawmill when set up in a track-sided trench, as shown in photo below.

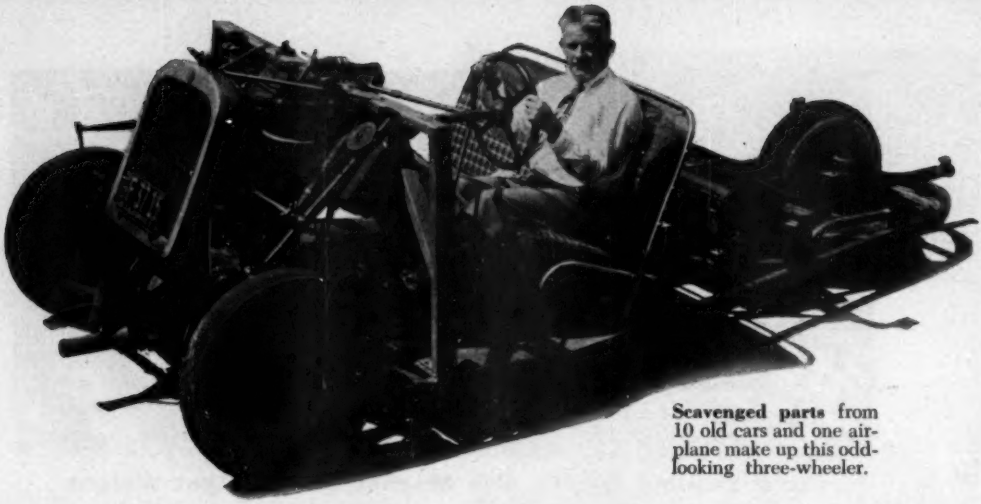
Bombers' Landing Wheels Use Magnesium for Light Weight

MADE of magnesium, the airplane wheels above combine great strength with light weight. Complete with dual brakes, they weigh only 308 pounds apiece. The photo shows them awaiting shipment from the B. F. Goodrich wheel and brake plant at Troy, Ohio, where they were manufactured. Fitted with tires, they will be used in bicycle-type landing gear of U. S. Air Force B-47, world's fastest stratosphere jet bomber.



Paper Shredder Uses Rollers that Need No Sharpening

THE shredder above never gets dull and can swallow paper clips and other metal tidbits without a hiccup. That's why the Navy uses it to shred confidential papers into 1/16-inch strips before burning them. The secret of why it doesn't need sharpening, as do some machines using blades, is a series of interlocking, blunt-edged rollers (inset). It would take many years for paper to wear them down, and even then they would only cut the paper finer. The ShredOmatic also has a device that turns old newspapers into curly ribbons for packing material, at right above. Its inventor, P. T. Lee, of San Francisco, says it can cut up to 32 thicknesses of paper at once.



Scavenged parts from 10 old cars and one airplane make up this odd-looking three-wheeler.

Tricycle Car Borrows Plane Ideas

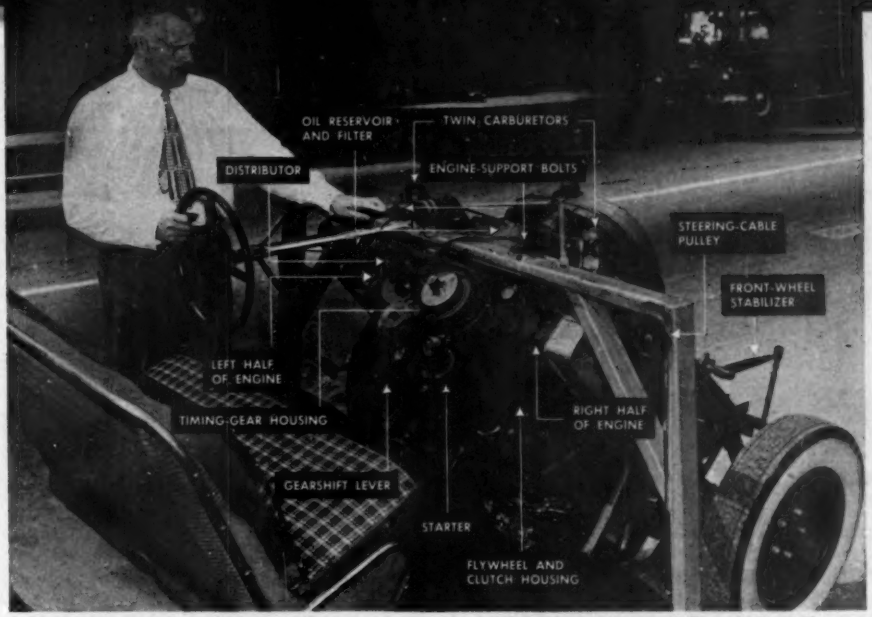
IF LLOYD HUNT has his way, you may someday see an odd, three-wheeled car roaring down a highway with only its front wheels on the road. Its tail, lifted by an airplane-type elevator, will be soaring in the breeze. This, thinks Hunt, may cut road friction and improve control at high speed.

Hunt, who is chief engineer for the Southern California Edison Co., hasn't completed his planing car yet, but the bodiless version shown here is already rattling around his home town of Glendale, Calif., giving uncanny exhibitions of maneuverability. Speed and semi-flight are still to come.

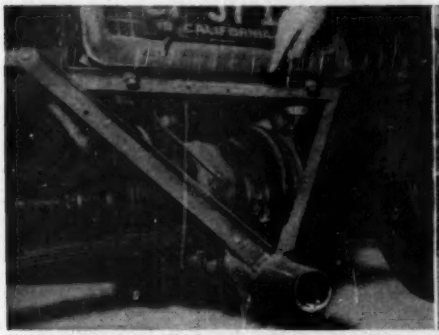
Junk yards are Hunt's happiest hunting grounds. From them, he has scavenged parts from 10 cars and one airplane to form his strange contraption. Unable to find a suitable power plant for front-wheel drive, he sliced up a 1925 six-cylinder Buick engine into three sections, discarded the two middle cylinders, and then aligned the two end sections to make a four-cylinder engine. The crankshaft, turned from a solid billet, revolves on castoff Timken bearings. Pistons are Auburn; rods, Hupmobile. Clutch and flywheel are from another Hup. Ford mechanical brakes are installed alongside a Ford differential connected to a Chevvy transmission. A Plymouth distributor, rebuilt to operate in reverse, delivers juice. A Dodge radiator cools water.

The car is steered by a single tail wheel, connected by airplane cables to a Chrysler steering wheel. In the completed version, the cables will also control an airplane-like rudder that Hunt hopes will take over steering when tail wheel is raised off the road.

Chalk marks show how Hunt, without moving forward or back, can swing car into tight space by pivoting on one front wheel. Car can make U turn in own length plus width—about 17 ft.



Square, channel-iron frame is main support for engine slung beneath it. Four-cylinder engine, mounted crosswise, is tilted back 45° to simplify connection to differential. Pulleys at frame corners carry steering cables back to single tail wheel. Seat is Chrysler Airflow.

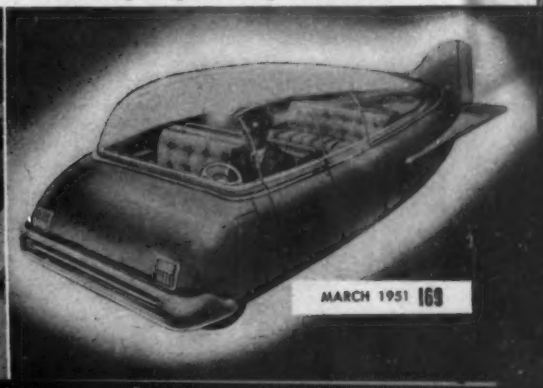


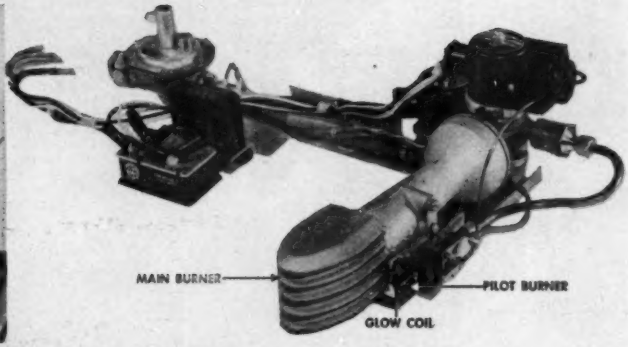
Ford mechanical brakes are mounted on either side of Ford differential turned upside down. Front end of drive housing, supported by V-shaped brace, projects forward like gun muzzle.

Head-on view shows broad engine-support frame that extends out to wheels. Front end of car is cushioned by inverted transverse leaf spring. Wheelbase is 131 inches; tread, 66 inches.

Single tail wheel is mounted in circular steel plate rotated by cables from steering wheel. Riding against roller bearings, it can turn 80° either way, is cushioned by airplane shocks.

Drawing shows how larger, seven-passenger version will look with completed body. Airplane-like elevator will lift tail, and rudder will take over steering. Top will be plastic dome.

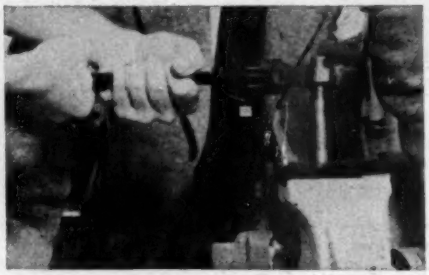




Gas Clothes Dryer Features Automatic Pilot Light

You don't need to use a match to light the pilot on this automatic clothes dryer. After the housewife loads clothes into the front of the cabinet, at left above, she flicks an electric starter switch. This turns on a glow coil in the burner assembly, at right, igniting the pilot light. The pilot then heats a mercury-filled capsule, producing pressure that operates a switch to permit the flow of gas to the main burner. When the burner lights, the appliance's drying cycle begins. If there is either a gas or electric power failure, the machine automatically shuts off. On return of the power, the interrupted drying cycle continues without being reset.

Made by the Whirlpool Corp., St. Joseph, Mich., the dryer holds 20 lb. of wet clothes. Heated air circulates through clothes tumbled in the drum, drying them completely, or damp-drying for ironing. A ⅓-hp. motor drives the belt assembly that rotates the drum. An ultraviolet-ray lamp helps sterilize the clothes.



Lack of Air Tightens Nut Sealer

A NEW plastic sealer hardens when away from air, and remains liquid when exposed to it—just the reverse of paint. Applied to the threads of a bolt, "anaerobic permafil" holds a nut tightly in place, eliminating the need for a lock nut. During a test, at left, a chemist strains to loosen a nut treated with the sealer. Developed by GE, the experimental material also seals threaded pipe joints, preventing leaks.

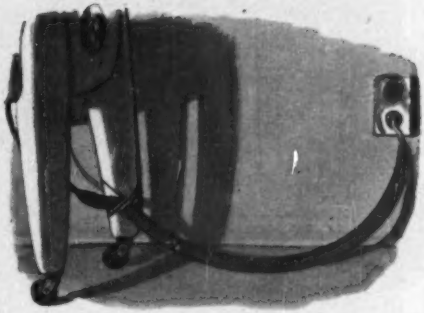
Navy Launches First All-Welded Aluminum PT Boat

AFLOAT at the mouth of the Severn River, the ship below is the Navy's first all-welded aluminum PT boat. Recently launched at Annapolis, Md., it is the forerunner of a new class of boats that will replace the famous mosquito fleet of World War II. The ship is 95 feet long, has a 25-foot beam, and is said to give a smoother ride. Built by John Trumpy & Sons, Inc., it is propelled by newly developed gasoline engines. Aluminum was used because of its light weight and resistance to corrosion.

Keeping the Home Shipshape

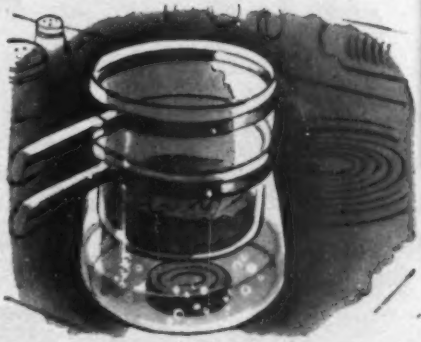
Pictures from children's coloring books make fine patterns for nursery decorations. Simply drawn, they are easy to transfer with carbon or by tracing. Use for lawn cut-outs, too.

A simple but efficient flowerpot holder can be formed from a wire coat hanger. Cut the cross rod apart at its center, pull down the two arms, and coil wire ends to fit the pot.



If your washing machine cord runs along the floor, protect it by taping a length of garden hose around it. Attach hose to washer leg to relieve wire of the hose weight.

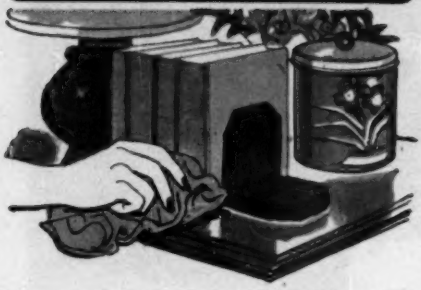
A broken oilstone can be cut off square with a hacksaw blade set backwards in the frame so that the smooth edge does the cutting. Kerosene or turpentine helps cutting action.



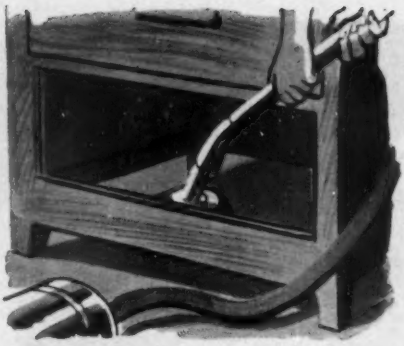
Put a Mason-jar lid in the bottom of your double boiler and it won't boil dry without warning. When more water is needed, noise of the bouncing lid will let you know.

Please turn the page for five more suggestions.

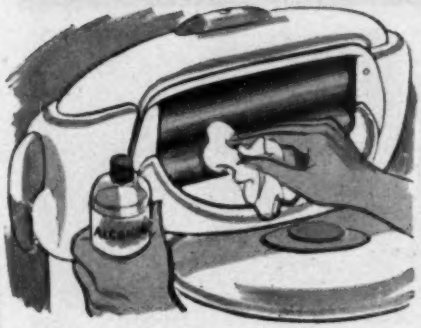
Keeping the Home Shipshape



Empty tobacco cans, enameled and decorated, make handy containers for keeping an oiled dustcloth in every room. No need for a trip to the kitchen for quick tidying jobs.



Don't move cumbersome chests of drawers to clean under them. Remove the bottom drawer and your vacuum attachment, or a long-handled brush, will reach in to get the dust.



Wringer rollers sometimes get greasy from handling mechanics' clothing. Alcohol will clean them safely. Never use cleaning fluids. They soften the rollers and cause sticking.

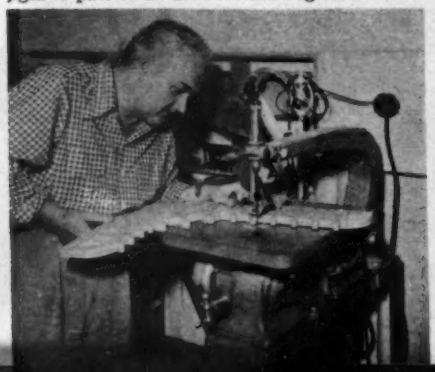
This album won't spill out phonograph records if accidentally tilted. A flap of heavy paper, glued to the back cover, folds over the records and is held tight by the front cover.

If you have trouble keeping wallpaper from rolling up while measuring and cutting it, screw two slotted posts to each end of the work table and insert yardsticks as shown.

Workshoppers' Tricks Tickle TV Audience

By Andrew R. Boone

Scenery as well as tricks comes from the Arquette and Willock workshops. Below, Arquette jigsaws part of an arch for a living-room set.



WHEN Cliff Arquette and Dave Willock build a television set in their home workshops, the only picture it shows is a test pattern—painted on. But it does things no normal receiver can. On cue (as shown in the picture above), it explodes, shooting the works out of the cabinet and blowing up the screen like a rubber balloon.

For this set is a prop, one of the many trick gimmicks that get the laughs on the

television show Arquette and Willock stage on Hollywood's station KNBH. The two actors dream up and make all the gadgets, and the scenery, besides. There's a clock that explodes, waving an American flag; a floating "hand" that fires a gun; a plate that cracks when the gun shoots; and an iron that burns its way through the pants being pressed and then through the ironing board.

The story of the show centers around a mythical newspaper, the *Mt. Ida Ledger* (net circulation, one copy), which Arquette and Willock also produce. The masthead is routed out of linoleum block on a drill press, while other parts of the paper are printed from regular type they keep on hand.

Both Arquette and Willock are veteran actors—and workshoppers. Arquette, a regular on the Fibber McGee and Molly radio show, among others, pursues dozens of craft hobbies (see "Hobbies Are His Hobby," PS, Dec. '38, p. 142). Willock has conducted a TV show based entirely on amateur woodworking—he would build a complete project during the half-hour program.

The moose head played a big part in a hunting sequence one week. Arquette, touching up one eye in photo above, made it from paper and fur.

Audience thought iron burned through pants and ironing board. Actually, wires lowered it through holes as Willock (right) blew smoke.

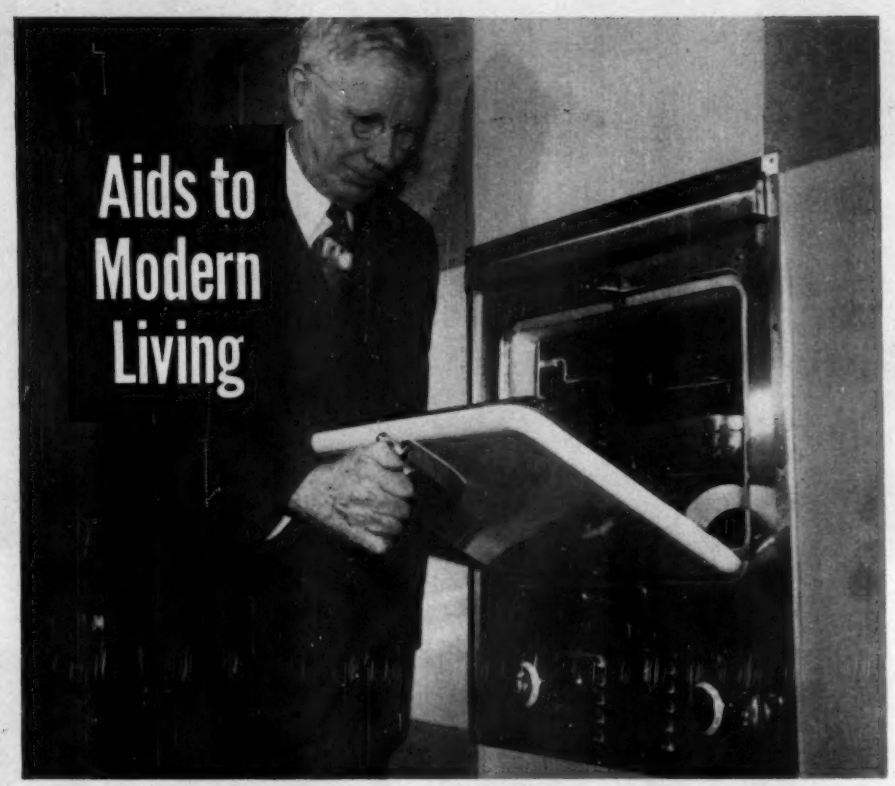
In sharpshooting scene, floating gun (on wires) fired at plate, cracking it. "Cracks" were zigzag paper strips, tripped by Arquette.

The *Mt. Ida Ledger*, mythical newspaper used on the show, is also homemade. The masthead is a linoleum block, cut with a ¼-inch router in a drill press (left) and finished with a hand gouge. After inking (center), the single copy is printed with a roller and peeled off (below).

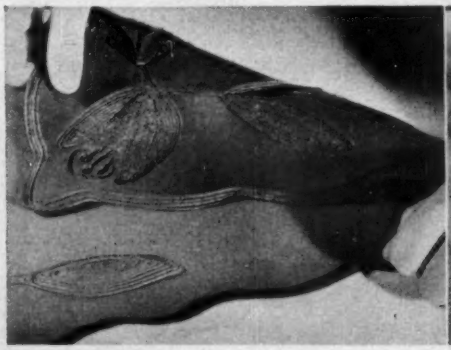
The script calls for the walls to shake and the pictures to tilt whenever a train goes by (left, above). Willock tilts the pictures easily with wires offstage (right). Weight keeps the picture tilted so that Willock can let go of the wire and get back into the scene.

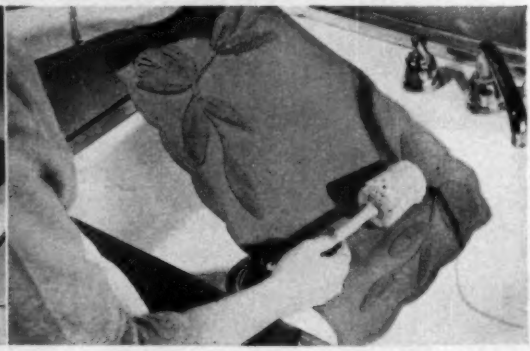
Prize example of craftwork produced for this program is a plywood replica of an old-fashioned stove, shown at left above before finishing and at right in realistic black. The range can't burn anything, but it makes a handy place to store props between shows.

Aids to Modern Living

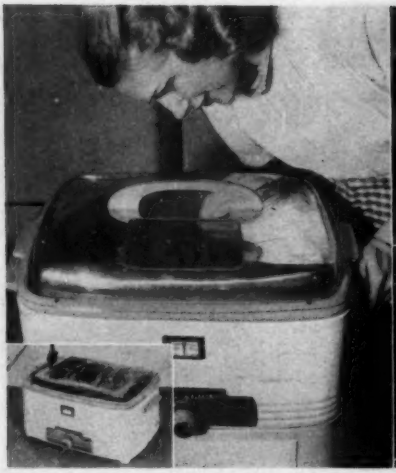


Oven Fits into Wall. New wrinkle in kitchen planning is to separate the roasting, broiling, and baking unit of the stove from the top burners by building the oven into the kitchen wall, as above. A top burner unit fits on a cabinet. Insulated with rock wool, the built-in gas units are made by the Chambers Corp., of Shelbyville, Ind.





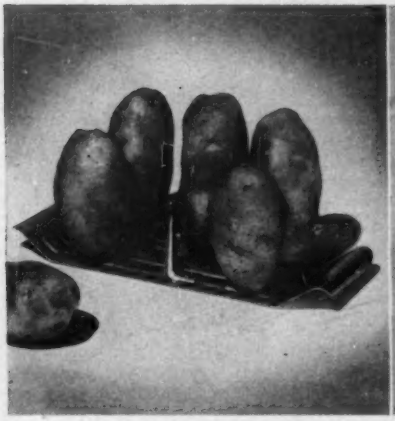
Plastic Mat Looks Like Linen. Thanks to a new process that puts an embossed, imitation-fabric design on flexible Vinylite plastic, this place mat looks like linen. Easily washed with a damp sponge or cloth, as at right above, the mat is wrinkle- and stain-resistant. Hedwin Corp., of Baltimore, Md., prices it at about 69¢.



Roaster Has Window. A heat-resistant window in this portable GE roaster lets the housewife watch food cook. Priced at $39.95, the oven holds a 20-lb. turkey, or 18 liquid quarts. The extra broiler-griddle, shown in inset above, costs $9.95.

Heater Drys Hair. The front of this electric wall unit drops, as in bottom photo above, to dry hair. A rack, top, pulls out for hanging wash. Also a cooling fan, it is sold by Fresh'nd-Aire, Chicago, for $39.95.

Box Traps Dampness. This fiberboard box removes excess dampness from a room, protecting equipment and clothing. A noncorrosive plastic-mesh bag contains calcium chloride to draw the moisture. Damp-Trap Co., Inc., Saginaw, Mich., makes it.



Spikes Aid Spud Baking. When potatoes are pierced with the aluminum spears on this tray, they are said to cook faster. The spikes carry heat inside a vegetable as its outside is baking. Joyslen Mfg. Co., Inc., Berkeley, Cal., prices the rack at $1.50.

Door Operates Dispenser. Mounted on the doorframe of a washroom, kitchen, or barn, this dispenser squirts a deodorant or insecticide every time the door opens and closes. Seco Products Co., Pittsburgh, sells it for $2.95.

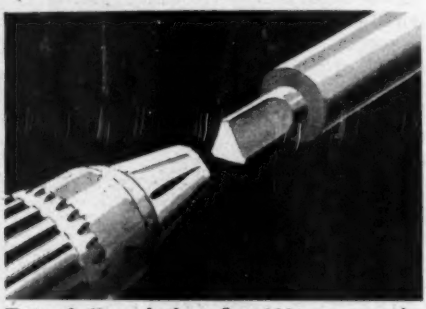
Pillow Is Inflatable. Sitting up in bed is made extra comfortable with this Vinylite plastic, 21- by 27-inch pillow. Quickly deflated by means of a turn valve, it folds into a small package. U.S. Fiber & Plastics Corp., Stirling, N. J., prices it at $3.

I'd like to see them make...

Controlled-beam lamps at sides of rear auto seats. Light directed to lap of rear rider would enable him to read maps or directions without lighting whole car and interfering with driver. —*R. E. Truett, Los Angeles.*

Automatic-metering water faucets that could be set to deliver any desired number of gallons of water. No more overflowing bathtubs and washing machines No more forgotten water sprinklers.—*Sue Butler, Los Angeles.*

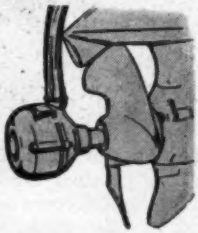
Coffee percolators, water kettles, and pots, with saucer-shaped bottoms. The saucer ledge would catch any liquid that might boil over and thus keep the stove clean and prevent the gas from going out.—*Ben Bubin, Jr., Miami, Fla.*



Twist drills with three flats 120° apart on the shanks to prevent slipping drill chucks. Would be especially good on bits with undersize shanks for use in portable electric drills.—*Lamar Schwalke, St. Louis, Mo.*

Heavy denim and corduroy patches that could be applied with a hot iron, requiring no sewing. Would be fine for patching children's jeans and overalls and men's work clothes.—*Mrs. G. H. Murray, Knoxville, Tenn.*

NOW they Make it . . .

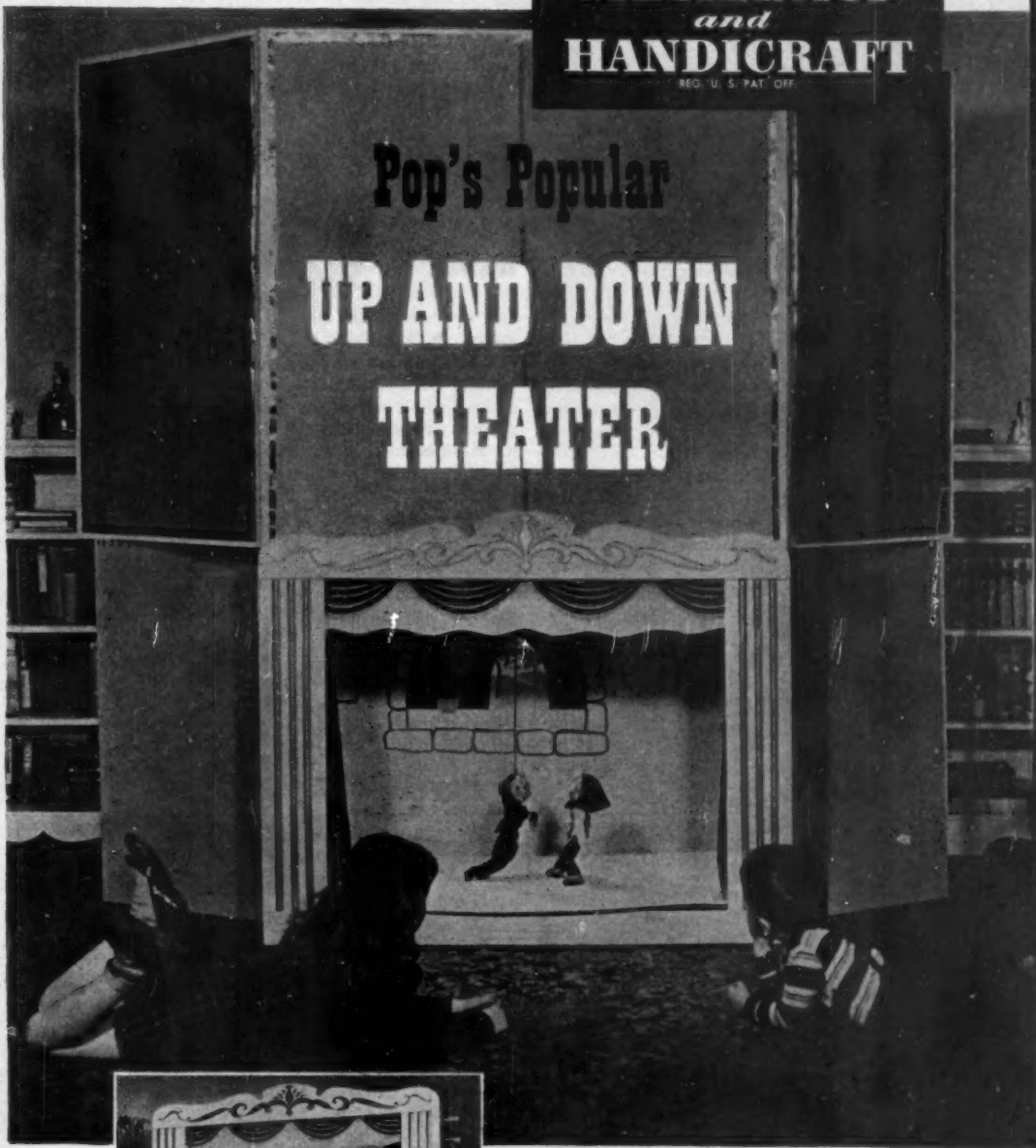


An automatic bailer on an outboard motor, suggested in Sept. '50 PS. If desired, an auxiliary hose also pumps clean water into boat and flushes out dirty water at same time. Made by Hydro-Jet Sport Products, Cleveland.

Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

MECHANICS
and
HANDICRAFT
REG. U. S. PAT. OFF.

Pop's Popular UP AND DOWN THEATER



Here's competition for TV—a home theater that's convertible for use with either puppets or marionettes, and knocks down flat for storage. Turn the page for instructions on building it.

Up and Down Theater

By Harry Walton

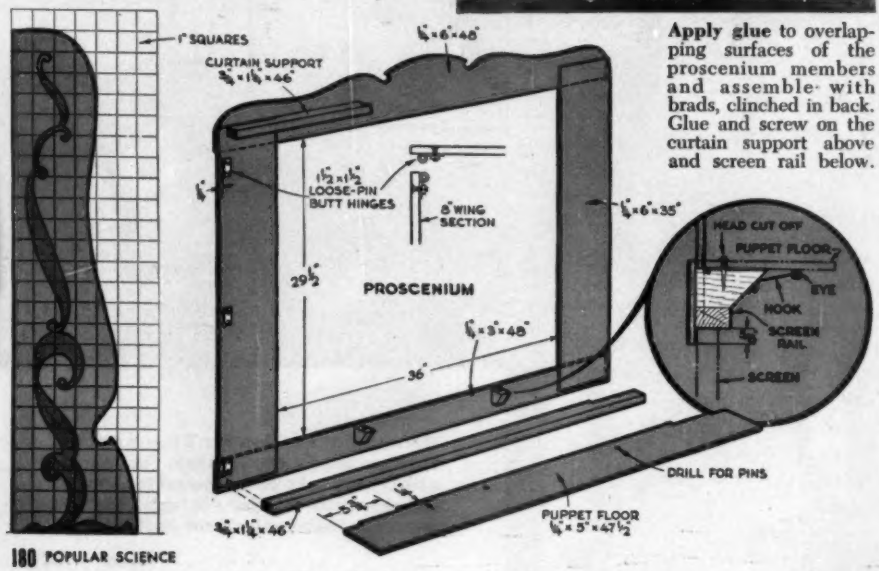
BROUGHT back by television, puppetry is making a hit with the young in heart of all ages, and the little dolls are becoming popular toys. But they're more fun if they have a stage on which to strut.

Build a puppet theater for the children, and you'll soon find yourself busy with it. In fact, this can be a whole family's hobby. Dad can make sets and props. Mother and sister can be wardrobe mistress and make-up artist. Brother can experiment with lighting. And everybody can take one or more voices in the cast. Plays can be found in most public libraries. Your audience? Just call all kids.

A combination theater. Once bitten by the hobby, you'll probably want to use both puppets and marionettes. This theater can be converted from one kind of show to the other in three minutes.

Since puppets fit over the hand and are worked from beneath, the stage stands atop a three-sided screen that conceals the puppeteer, who kneels or sits on a stool behind it. Marionettes are manipulated by strings from above. So for marionette shows the

Apply glue to overlapping surfaces of the proscenium members and assemble with brads, clinched in back. Glue and screw on the curtain support above and screen rail below.



stage goes on the floor or on low blocks, its wings opened to support the screen on top. The opened wings permit side entrances for the players, who walk on like live actors. You can build the theater for puppets now, and add the marionette stage floor any time later.

Although big enough for professional use, being 4′ wide and 7′ high, the theater knocks down into "flats" for storage, and can be transported by automobile.

Pick your materials. All the parts of the puppet stage can be cut from a 4′ by 8′ panel of ¼″ plywood, which is ideal because it's comparatively stiff. Cheaper material such as composition board or even heavy cardboard can be used for the stage wings if stiffening cleats are added.

You'll also need about 60′ of ¾″ by 1¾″ (nominally 1″ by 2″) stock for the screen, cleats, and incidentals. The marionette floor calls for an extra 28″ by 48″ panel and two 5″ by 35″ legs, all ¼″ sheet.

Theater front. The proscenium, as it's called, is a frame built up of four pieces of ¼″ plywood. You can cut the top straight across and depend upon painting or strips of half-round molding for ornamentation, or saw it to a fancy curve as in the drawing.

The stage wings. Each of these consists of two pieces, hinged together. Glue and screw battens along the adjacent edges to stiffen the wings vertically and provide anchorage for the hinge screws.

Fasten horizontal battens ¾″ from the bottom edges of the 20″ wide wing sections, using small flathead wood screws and glue. Cut 5/16″ by 1″ notches in the top of both wing sections for backdrops and scenery. Your various sets can be painted on cardboard, the upper edges being stapled to battens that fit these notches.

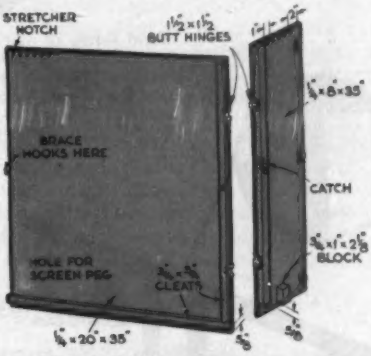
A narrow floor fits between the front portions of the wings, as shown in the pictures.

The screen. Cut all 12 frame members to full length first. Then saw half-lap joints at each corner. Assemble with glue and two wood screws at each joint. Check for squareness by measuring the diagonals. Judicious pressure on the corners before the glue hardens will square up a frame if it's slightly out of true. The diagonal braces in the big frame can be glued and toenailed.

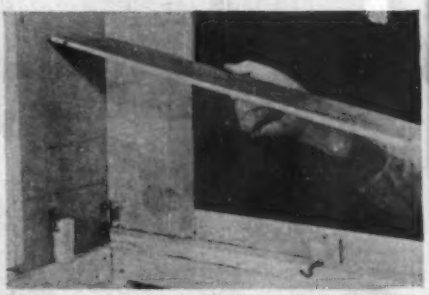
Hinge the three frames, as in the drawing, to open all the way outward. Loose-pin butts will let you take the screen apart for storage.

Cover the screen panels (after painting

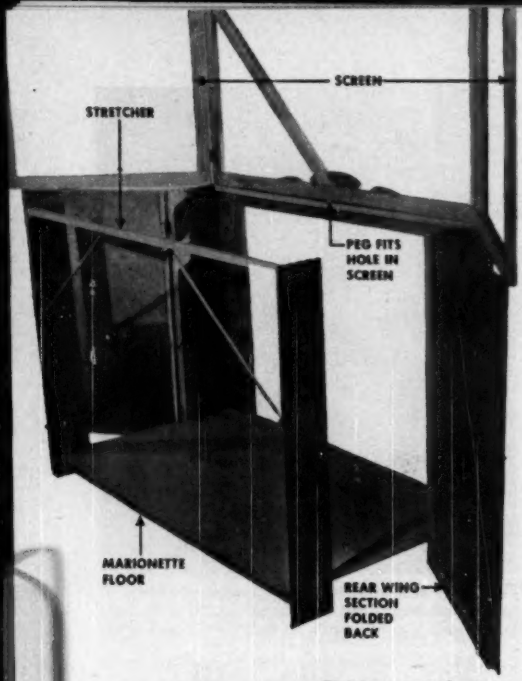
For easy disassembly, wings and proscenium are joined with loose-pin hinges, held with flathead bolts (countersunk in the wood) and nuts.



STAGE WINGS



Insert puppet floor, which is a 5″ shelf. Holding it in place, drill two holes through it into the wooden blocks. Turn in wood screws and cut off heads, leaving short pins. Hold shelf with hooks to front and wing blocks.



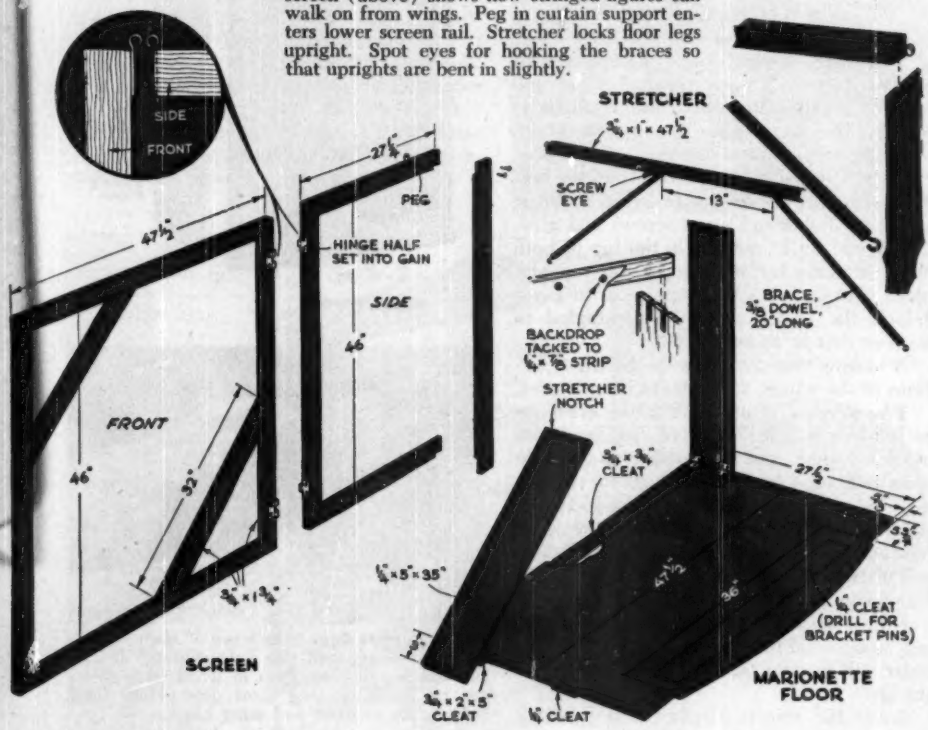
the frames) with standard 28" by 44" poster board. This comes in a variety of colors, saving you the trouble of painting large areas. Tack or staple the board on, and cover the edges with molding or linoleum binding.

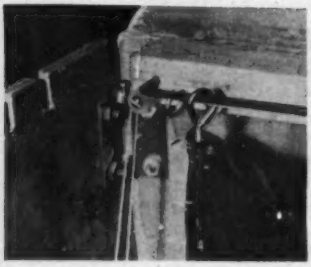
Mounting the stage. With the sides attached to the proscenium and the puppet floor in place, have somebody help you place the theater on top of the screen. Although light, the unit is unwieldy to handle alone.

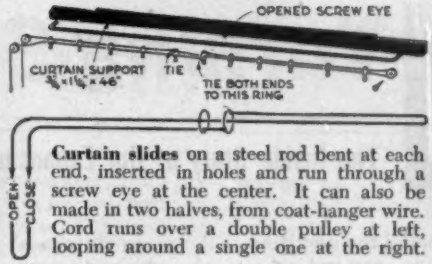
For the pegs that hold the stage on the screen, bore ⅜" holes through the horizontal wing cleats into the upper screen members. Glue ⅜" dowel pegs into the screen rails and open out the holes in the wing cleats to take these alignment pegs easily. Mount the stretcher and its braces, and you're ready for a puppet show.

Marionette floor. To let the stringed folk walk the boards, you need a floor the full depth of the stage. This may be plywood or, if well cleated, fiberboard. Cut a

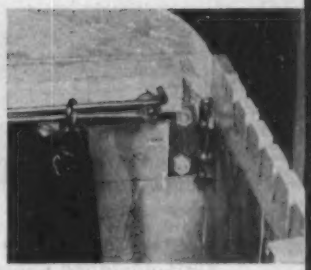
Trial setup of marionette floor with uncovered screen (above) shows how stringed figures can walk on from wings. Peg in curtain support enters lower screen rail. Stretcher locks floor legs upright. Spot eyes for hooking the braces so that uprights are bent in slightly.







Curtain slides on a steel rod bent at each end, inserted in holes and run through a screw eye at the center. It can also be made in two halves, from coat-hanger wire. Cord runs over a double pulley at left, looping around a single one at the right.



curve on the front edge, which projects beyond the proscenium opening. Drill two holes in a piece of ¼" plywood at the same spacing as the ones in the puppet floor. Glue this piece to the underside of the stage to engage the pins on the floor blocks. Also glue a cleat ¼" thick under the floor at each side where it rests on the wing blocks.

Glue and screw cleats along the back of the floor as shown in the drawing. Screw hinges to the short cleats and with bolts and nuts attach the two plywood legs. When opened and locked with the stretcher and its braces, they hold the back of the marionette floor level with the front.

If you're going to do much marionette work, fasten a board 3" wide on top of the stretcher for a more adequate arm rest. Let this rest on top of the legs, leaving the notches open for the backdrop battens.

Screen goes above. For marionette shows, glue a peg in the middle of the curtain support behind the proscenium and bore a hole in the lower rail of the middle screen panel to receive it. Hinge back the rear sections of the wings about 45°, and open the side screen panels to rest on them. Mount hooks, catches, or turn buttons to secure the open wing sections to the lower rails of the screen.

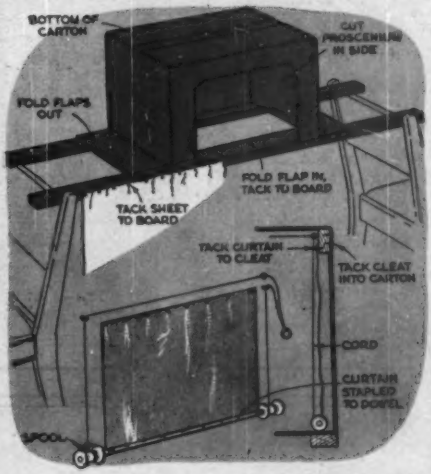
Curtain time. That breathless moment when the curtain goes back is pure magic—provided the curtain behaves. The material must have enough body to hang in smooth folds. Cut two pieces, each 10" wider than half the proscenium opening. Hem the cut edges, and sew six to eight small rings or S hooks to the top of each half. Wax a strong cord and rig it as in the drawing, tying the ends to the middle rings with the curtain drawn shut. Where the cord changes direction at the ends, run it through screw eyes or over small pulleys. The photo above shows small lathe-turned plastic pulleys that revolve on wood screws. Miniature pulleys sold for ship models will serve nicely. END

Grocery-Box Puppet Theater Built in a Jiffy

THE kids will love this quickie "all their own" theater, which you can make in an hour from a cardboard carton. The bigger the box the better; 14" by 15" by 20" is the minimum size.

Cut the proscenium opening in one side of the carton. Cut the flap on that side to 3" in width, fold it in, and tack it to a batten about 2' longer than the box. Fold the opposite flap out parallel to its side and tack it to a second batten. Tack an old sheet onto the front board and place the theater across the backs of two chairs. The puppeteer kneels or sits on a low stool.

If you want a curtain, tack a piece of wood over the proscenium inside the box. Drive two spools over the end of a length of dowel, tack the curtain to the proscenium board and the dowel, and rig a control cord as shown to roll the curtain up.



Turning Space

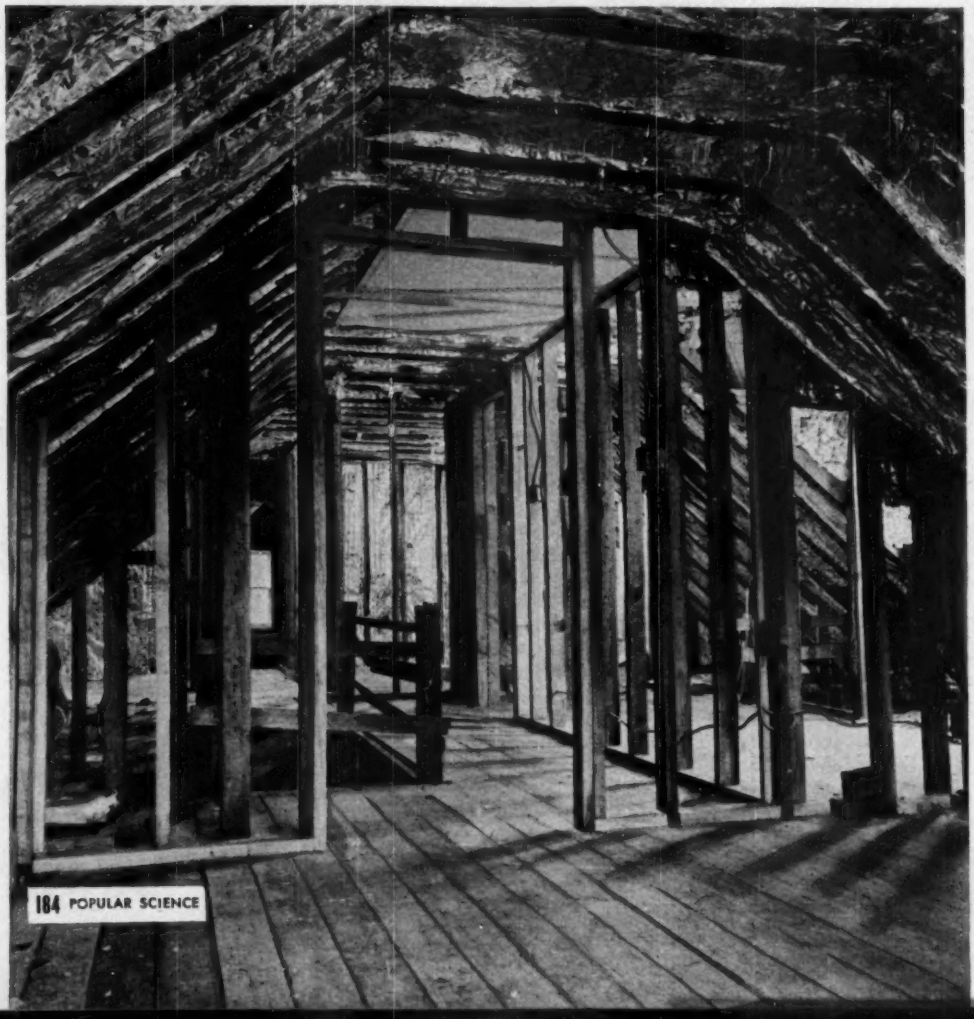
The Inside Story of Our Expansion Attic (PART 2)

How the Goodmans framed the partition walls, installed studding, and put up insulation and plasterboard.

WHERE there was only an unfinished attic a year ago, we now have three bedrooms and space for a bathroom. By doing the work ourselves, my husband and I saved nearly $1,500, had a lot of fun, and learned plenty. This account of some of the things we discovered may help other couples who need more space.

We realize better now than we did at the start that we were fortunate in having an architect's help. When we finished the subflooring, for example, we did not have to stop and figure out what to do next—we simply turned to his plans and plunged on.

By then, we had learned the terminology of house construction: *rafters* are the slant-



into Rooms

By Mary Ellen Goodman

PS STAFF PHOTOS

ing beams that support the roof, *studs* are vertical members supporting the partition walls, the horizontal pieces they stand on are *sole plates,* and the horizontal ones that are used to tie the studs together at the top are *top plates.*

Collar beams are the horizontal members tying opposite rafters together. Sometimes they are near the peak of the roof, sometimes farther down. Ours were barely head high, and this brought us up against the case of the missing collar beams.

More were needed. When our house was put up, ten years ago, the builder had adequately braced the roof with collar beams tying together every other pair of rafters. But they were too far apart to support insulation and the wallboard ceiling properly. So we had to install the missing collar beams.

For these, we used two-by-fours, which did not have to be cut precisely, because we nailed them against the sides, or faces, of the rafters. In the center and south rooms we lined the beams up by temporarily nailing lengths of wood across the existing

Our house had collar beams across every other pair of rafters. To line up those between, we nailed battens across two existing beams, and laid the new one on the battens. After nailing it, we took down the temporary supports.

Get set to hit the nail squarely, even if you must stand over the stairs, like me. End studs for this wall were set plumb with a level. Then a line was stretched between them to line up top ends of others.

Double studs in doorways give extra rigidity to withstand slamming doors. The two studs are joined with tenpenny nails, spaced 16" apart and staggered. Here our Steve watches his father nail an inside stud to the sole plate.

We scotched cold drafts that might have come in around windows by packing around frames and under sills with rock wool. Reflective insulation went everywhere else, as shown on the next page.

Accordion-type insulation, a paper honeycomb with three layers of aluminum foil, was light to handle and easy to install. The end of the strip was first tacked to the rafters at the eaves, with a small overlap at the sole plate.

One side of the strip was stapled right along a rafter, as above. Then the accordion pleats were pulled open and the taut material stapled by its other edge to the next rafter, as below.

beams and setting the new beam on these strips.

In the north room the existing collar beams were only six feet from the floor. The architect, who is 6′ 3″, recommended raising them to 6′ 6″, but we are shorter folk and felt we could get by with a little less. We simply laid the new beams right on top of the old ones and nailed them to the rafters. This placed the new beams higher by the width of a two-by-four, or at a height of 6′ 3¾″ from the floor. Then we removed the old beams and nailed them up between the new ones, using a temporary batten to line them up, as we had in the other rooms.

We learn about nailing. Since we were going to use a lot of two-by-four lumber, we persuaded our dealer to give us the quantity discount even though we ordered only two or three hundred feet at a time. We used well over a thousand feet before we finished the job. At first we ordered 14′ lengths, but later we found we wasted less by using 8′ pieces.

We used sixteen-penny nails for collar beams and sole plates, and tenpenny nails for all other framing. As an aid in proper nailing we recommend a pamphlet, "Techniques of House Nailing," published by the Housing and Home Finance Agency in Washington. This can be bought from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 15 cents. It not only tells what size nails to use, but how many and where to drive them.

The secret of driving nails right is to get yourself in position to hit the nail squarely with a full hammer swing, even if this takes some preliminary gymnastics. We stood on planks placed across our sawhorses. Although these had to be moved a good deal, it was worth the trouble. The sawhorses and planks were all we needed. To this day we don't own a stepladder.

Blueprint on the floor. Once the collar beams were in, we were ready to transfer our architect's plan to the floor boards. First we dropped a plumb line from the ridgepole at several points to find the center line of the house. With this marked on the floor, we measured from it according to the blueprint. This gave us the outline of the east and west walls. North and south walls were predetermined by the setbacks at each end of the house and the chimney at the middle.

Next we placed the sole plates (two-by-fours) on the lines we had drawn, and

fastened them with sixteen-penny nails through the subfloor into the joists, whose location was already marked by the flooring nails. The sole plates were interrupted wherever the plan called for a door. Thus, when the plates were down, we had an outline in two-by-fours of the rooms to come.

The sole plates had to be measured carefully and cut square to make doorways the proper width, corners abut solidly, and doorway studs fit accurately. A friendly carpenter showed us how to saw square and true. Draw the line carefully, he said, and then look down on it directly over the saw. By keeping both eyes open you will seem to see the line on each side of the saw, and can easily cut "between" what you see.

We aligned the top plate for the center walls (the only ones that did not run up to the rafters) by dropping a plumb line from the collar beams to the sole plate. To hold the top plate in place for nailing to the collar beams, we cut the two end studs of each wall and set them under it. Each of these and the intervening studs was cut individually to fit the spot where it went. This was necessary because even a slight difference in length caused trouble. If studs were too short they wouldn't stay in place while we nailed them; if too long, they bowed and did not present a square face for the wallboard.

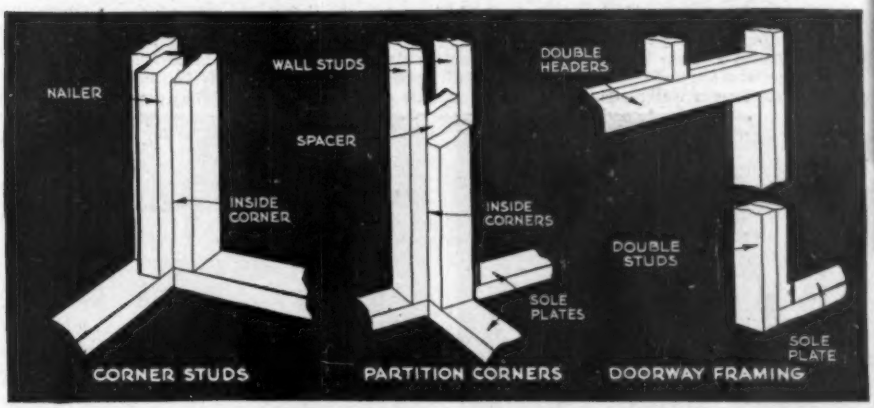
In fastening studs to the top plate we learned about toenailing. It took practice to get the hang of driving a nail diagonally through an upright into a horizontal member. The hammer blows tend to shift the upright out of position, and at first one of us held while the other nailed. But this seemed inefficient, so we drove nails temporarily into the plates to hold the studs in place. In toenailing as in straight nailing, it is important to smack the nail squarely and with a full swing.

Watch that spacing! The most important—and expensive—lesson we learned in this part of our attic project was that studs must be 16″ on centers (as measured from center to center). You can't get by with 15″ or 17″, because insulation and walboard are designed for standard 16″ spacing. Our builder had not been overly careful about this, and neither were we at first. It cost us dearly both in time and money.

We can testify now that it's even worth the price of extra two-by-fours for double studs to maintain that vital 16″ spacing.

A less serious error that we made was to forget nailing strips around the dormer and at the rafter ends. You can't nail wallboard to empty air, or to a member an inch away. A stud at the outer corner does you no good when you want to nail board on the inside of the wall. We remembered to build out the inside corners of the rooms as shown in the drawing, but we used 1½″ by 1½″ stock, which was far too light. By the time we got around to installing the wallboard, we learned to use two-by-fours. But it was much harder to set them in after the insulation and part of the walls were up.

With the end studs already in place for the center walls, we ran a string taut between them to line up the other studs, setting them squarely on the sole plate. We checked with a level to make sure the studs were vertical. For the walls that ran right up to the rafters, we first set the end studs on the sole plate and used the level to find



We saved a third the cost of our wallboard by covering eaves areas, behind closet and storage space, with corrugated cardboard. It was a cinch to put up with the stapling gun. If ever damaged, it will cost nothing to fix.

the right point on the rafters at which to nail them.

Double studs and a double header (the horizontal crosspiece on top) in each doorway are standard practice. The inside member of the double stud goes down to the subfloor and is nailed to the end of the sole plate; at the top it's cut short to fit under the header. The second stud, outside it, rests on top of the sole plate but runs up past the header to the top plate or rafter.

Ceiling grilles were installed in each room, and a trap door in the south room. Through this we can install and service an attic fan. For grilles we used hot-air registers, which can be closed in winter by turning a small wheel. The trap, which is 32″ (the space between two rafters) by 24″, is made of two layers of plywood with rock-wool insulation between. It is hinged on the south wall and held up by a catch.

Insulation came next. While the wiring was being installed—a center light and two wall double outlets in each room, plus lights in the closets and a two-way switch circuit for the stairway light—we considered various types of insulation. We finally chose one made of three layers of aluminum foil, two light and one heavy, held together by a honeycomb of fire-resistant paper. It is small in bulk and relatively easy to install. The 1,600 sq. ft. we required came in a carton no larger or heavier than one containing a mere 80 sq. ft. of rock-wool bats.

To put up our insulation, we unfolded one end of a 250′ strip and, using a stapling gun rented from the dealer, attached one paper flap to the side of a rafter from the eaves to the collar beam, across the collar beam, and down the far eaves. Then we unfolded the strip all along its length, opening up the honeycomb so that it spanned the distance to the next rafter. Pulling it taut, we stapled it to the inside of this rafter, leaving an airtight sheet of aluminum foil facing the room, with a honeycomb of air spaces and two other reflective layers of foil above it.

We forgot some of the instructions the salesman gave us, and the manufacturer's instruction slip was in the bottom of the box. So, of course, we put in a few hundred feet backward before we realized our error. But we were assured that it wouldn't reduce insulation efficiency enough to matter, so we left it that way.

At this point, uneven spacing of rafters became bothersome. Wherever they were more than 16″ apart, we had to run the insulation across instead of along the rafters, overlapping the short sections 4″ at every joint. This method of installation cost us

Wallboard was held against sloping ceilings by a batten spaced ⅜″ away from the rafters. Lower board edge was aligned against another batten nailed across tops of wall studs.

We leaned plasterboard against the studs for cutting it to size. It broke cleanly along a scribed line, leaving only the backing paper to be cut through with a sharp knife.

25 percent more in material, and of course a lot of extra trouble. The 4″ overlap was necessary, however, around obstructions such as the ceiling grilles.

Rooms take shape. To finish the walls and ceiling, we chose plasterboard. Although it is harder to work with than some boards, it was the cheapest one available.

Measuring the areas carefully, we tried to order lengths that would work out to best advantage with the least waste. We stored the plasterboard in our garage on blocks, moving sheets upstairs only as we used them. For the first time we were forced to call on friends and neighbors for help, as I couldn't carry my end of the 4′ by 8′ lengths. One of these neighbors came up with an idea that saved us a lot of work and considerable money.

Toughest fitting job was where dormer peaks met the sloping ceiling. We adjusted one leg of a folding rule to get cutting angles for sawing two-by-four nailing strips. One arris of these was chamfered to present a suitably parallel nailing surface.

Since the space behind the side walls was to be for closets and storage, the eaves wouldn't show. Nevertheless, we wanted to cover them to protect the aluminum insulation. Our friend suggested that corrugated cardboard from cartons, stapled to the rafters, would be adequate for this. We were able to cover nearly a third of the attic with such cardboard, saving just that much wallboard.

Despite the careful measurements we had made before ordering wallboard, we had a lot of waste because our studs weren't on 16″ centers. Sometimes three studs spanned 34″ instead of 32″, making us scrap as much as 14″ of a board 4′ wide.

Professionals lay plasterboard flat on sawhorses for cutting, but we preferred to stand it against a wall. Measuring the area to be covered, we marked off the board and scribed the lines with a chisel. (We had to buy a new chisel later, for this wrecked the edge. The experts recommend a linoleum knife.) The board cracked readily along the scribed line, and we then cut through the backing paper with a knife.

To lay out the angular cuts where the boards had to fit under the eaves, we measured the height from the floor at two points the width of the piece apart, marked them on the board, and drew a straight line between them. The necessary openings for electric switches, outlets, and fixtures were roughly located on the board and a small hole punched for each. Then, with the board loosely in place, we inserted a keyhole saw and cut around the box.

Our dealer sold us 1¾″ galvanized shingle nails to hold the plasterboard in place. We spaced these 8″ apart on vertical surfaces, 6″ apart on ceiling and eaves areas. These overhead surfaces were the back-breaking part of the job. To get the plasterboard in position on the sloping ceilings, we nailed a batten across the ends of the collar beams and another at the top of the wall studs. A third batten was nailed between these, but spaced away from the rafters by ½″ blocks. The board was then inserted between this third batten and the rafters, and moved about against the others until it was square.

For boards that went directly overhead, a single batten nailed over spacing blocks proved adequate. Where we had to fit plasterboard around the ceiling grilles, we found it much quicker to cut two or three pieces, each fitting part way around, than to cut one piece to an exact fit.

Along the edges of the wallboard, nails were driven in the shallow recess provided. The proper technique here is to hit nails enough to sink them a bit below the surface, but not so hard as to break the board. We had some broken edges and corners, but consoled ourselves with the thought that molding and patching plaster would conceal or repair them.

Mrs. Goodman's story of her attic will be continued next month.

Piece of Wiper Blade Mounted in Handle Spreads Glue

A SHORT length cut from a discarded windshield-wiper blade makes a glue spreader (left) that is easier to use and to clean than a brush. Cut a handle to shape on the bandsaw and round off and smooth on the sander. Drill a ⅜" hole parallel to the end, and then cut a kerf through and beyond it. Drill a hole for an 8-32 bolt to clamp the blade.—*H. Neustadt, The Bronx, N.Y.*

Set Brakes When Washing Car

BEFORE washing the family car, pull the emergency brake tight. Also press down the brake pedal and prop it with a stick. This will keep water out of the brake linings. If these get wet, brakes may not hold for awhile.—*H. Muller, Danboro, Pa.*

Tool Opens Vacuum-Sealed Jars

AN OLD knife can be turned into a handy kitchen tool (right) for opening vacuum-sealed jars and bottles. Cut off the blade near the handle and grind the stub to a slight concave curve. This will slip snugly under a cap.—*G. Nepper, Ft. Thomas, Ky.*

Record Album Holds Saw Blades

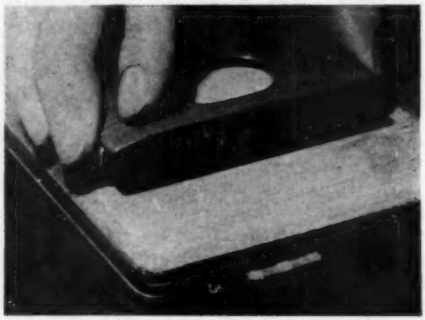
WHEN my wife discarded a slightly beat-up record album, I grabbed it fast. Now I file my circular-saw blades safely and neatly in the pockets.—*Pat Comstock, Manhattan.*

Funnel Supports Flashlight at Angle

IF YOU'RE stuck with a repair job in a poorly lighted spot, and haven't a helper to hold the flashlight for you, try the setup shown at left. Slide the flash forward or backward within the rubber band on the funnel until the light shines just where you want it.—*John Patrick Corcoran, Dover, N.J.*

Blade Dispenser Makes Sanding Block

AN EMPTY double-edge razor-blade dispenser of the type shown below makes a handy sanding block for small work. Use the kind containing a spring. Wrap a strip of sandpaper around the curved bottom of the plastic case and tuck it through the two open ends of the dispenser. The spring keeps the sandpaper in place.



Cobbler's Bench Holds Smokes

This hand-tool quickie looks well on the living-room table.

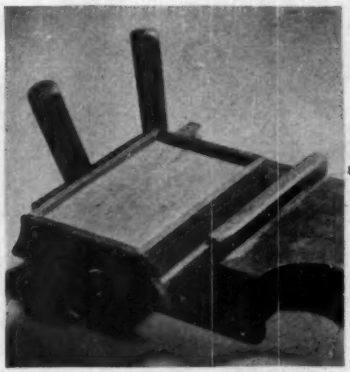
STANDARD cigarettes fit into the tray of this little cobbler's bench, and the drawer holds match books.

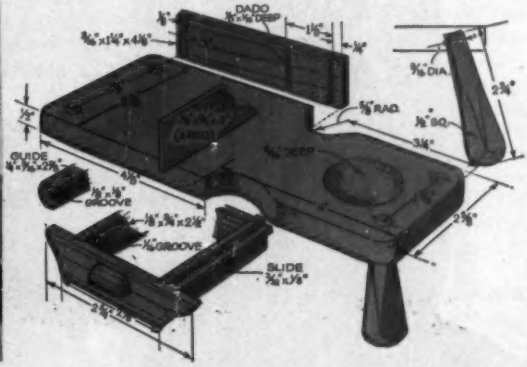
Jigsaw the bench top out of ½" stock and gouge a shallow hollow for the ash tray. Drill 5/16" holes for the legs, angling them slightly away from the corners. Legs can be turned, or shaped with file and sandpaper, from ½" square stock. Round the big ends well. Glue the legs in.

The tray is built up on the top, the sidepieces being dadoed for the ends and partition. Round off all corners and edges. Dado the drawer front for the sides, and the sides for the back. Run a groove around the inside for a drawer bottom cut from veneer stock or tin plate.

Two slides, glued to the outside of the drawer, run in grooved guides fastened below the tray end of the top. Whittle the drawer handle out of solid stock.

Finish with wax or boiled linseed oil, and rub well. The ash tray can be hammered from a piece of copper or pewter.—*L. T. Cronk, Valhalla, N. Y.*

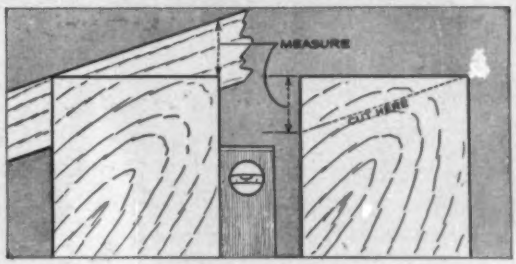




Cutting Boards at an Angle by the Fit-and-Mark Method

WHEN you want to fit boards vertically to rafters and don't have a bevel square, try this method:

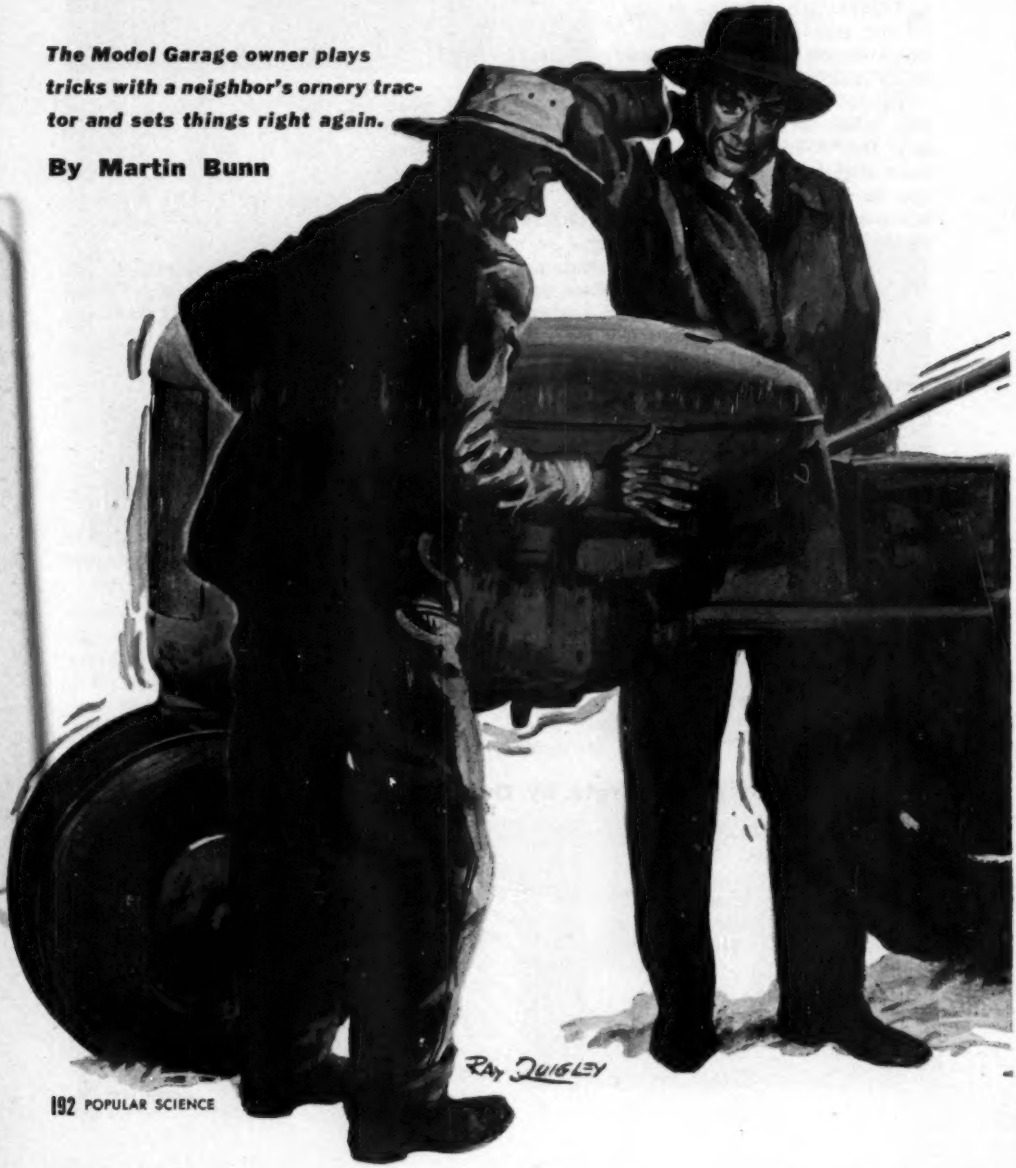
Measure from the end of the vertically held board to the rafter, as shown in the drawing at the right. Transfer that measurement to the opposite side of the board and then saw from there across to the first corner.—*Joel Miles, Denver, Colorado.*



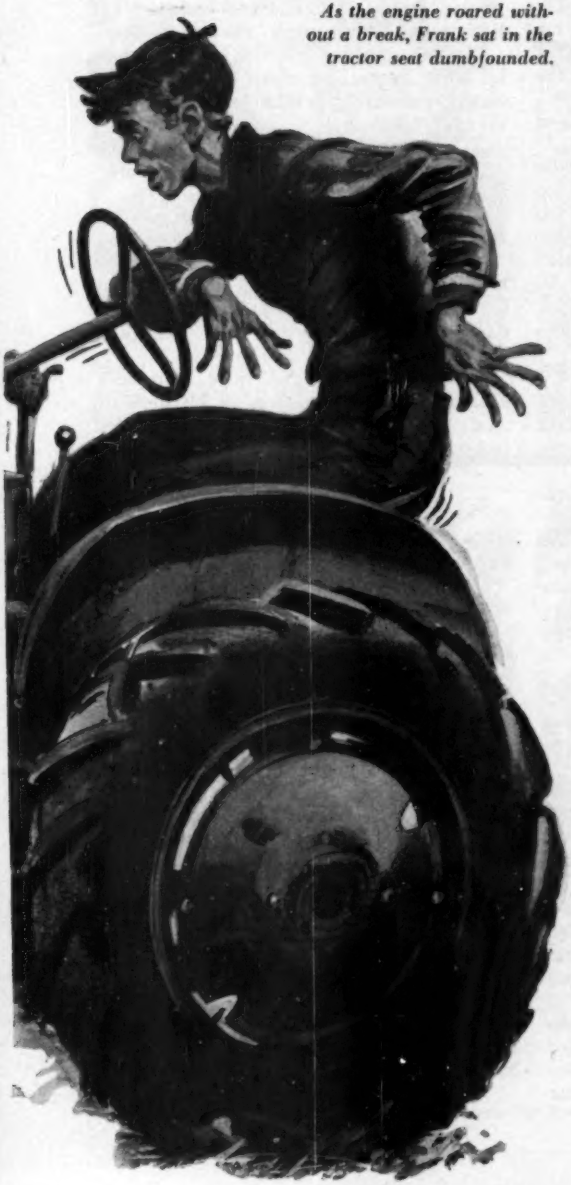
Gus Finds Two Rights Can Make a Wrong

The Model Garage owner plays tricks with a neighbor's ornery tractor and sets things right again.

By Martin Bunn



AT ABOUT this time every year, Gus Wilson always gets a rash of S O S calls from the local farmers. Quite a few of them who think they are handy with tools spend part of the winter months trying to get their trucks and other farm gear in shape for the spring. Then, when they get into trouble—and they often do—they invariably call on good old Gus with a last-minute fix-it plea.



As the engine roared without a break, Frank sat in the tractor seat dumbfounded.

Most times Gus doesn't mind. February and March usually are slow months at the Model Garage. The big rush doesn't start until April when folks begin thinking about getting their cars ready for warmer weather.

This year, though, things got a little ahead of themselves. A few stretches of downright balmy weather had Gus Wilson's shop jammed to the doors with repair jobs and tune-ups by the end of February. As a result, the veteran mechanic had to stick pretty close to his bench.

There was one call for help, however, that Gus just couldn't bring himself to turn down. It was from his old and very good friend Mel Mowbray. Mel and his wife were two of Gus's favorite people. It seems that Mel had a new hired hand who'd talked Mel into letting him overhaul the tractor. He'd evidently botched the job, because Mel had asked Gus to come to the rescue.

So one Sunday recently found Gus driving up the long lane that leads to Mowbray's farm. As he neared the house, Mel headed toward him from the barn.

"Sure swell of you to give up your Sunday and drive all the way out here to help us," Mel said appreciatively after Gus had parked his car.

"Can't let an old friend down," Gus replied with a smile. "Besides," he added with a wink, "I haven't had a piece of Mrs. Mowbray's deep-dish apple pie in ages."

"How about a cup of coffee right now, Gus?" he said ushering the mechanic into the big farm kitchen.

A few minutes later, after Mrs. Mowbray had brought them two steaming cups and a plate of hot buttered biscuits, Mel began telling Gus his troubles.

"I'm in a spot, Gus," he said. "This early spring has sort'uve caught me unprepared. I'll be needin' my tractor pretty soon now and it's in no shape to be of much use."

"What happened? Your new hired hand take it apart and forget how to put it back together again?"

"Not as bad as that. Last fall, when we put it up for the winter, I knew that she needed a general tune-up and probably new rings and a valve job. I made

my mistake by letting Frank—that's my hired hand—talk me into letting him do the job. He meant well—wanted to save us the money."

Gus nodded, reaching for another one of Mrs. Mowbray's biscuits.

"Well," Mel continued, "he put in the new rings, ground the valves, and took care of a few other repairs. Finished the job last Friday. He was a proud youngster when he cranked her up and she took hold and purred like a well-fed kitten. That is, he was proud until he gave her the gas. Then she began to sputter. Sounded like she was only hitting on three cylinders."

"Did he check the timing?"

"Gus, he's been checking everything ever since. The poor kid hasn't done anything else. He's out there in the barn right now going over that engine piece by piece."

"Let's amble on out," suggested Gus, gulping the last swallow of his coffee. "Tractors aren't my meat, but maybe the three of us can gang up on the trouble."

As the two men walked into the barn they found Frank, grease-smeared and dejected, carefully checking the ignition wiring.

Gus Meets Susie the Tractor

"Frank," called Mel, "this is Gus Wilson. He's come out from town to see if he can help us find out what's ailin' old Susie."

"Having troubles, Frank?" Gus grinned as he gripped the younger man's hand. "Since I gather it's a she I wouldn't feel too bad. Females are always temperamental. Got any theories?"

"Gosh, Mr. Wilson, that's just it, I haven't got a one," Frank admitted. "Everything checks out as it should, yet she misses when you give her the gas."

"Let's hear her idle."

Just as Mel had said, Susie started without a falter and idled smoothly.

"Now give her the gas."

Frank complied and the tractor engine picked up from a pleasant purr to a stuttering roar. There was no doubt about it, Susie had a bad miss.

"It's the No. 2 cylinder, I'm sure," Frank said after he had shut off the ignition and climbed down from the tractor seat.

"No. 2 plug okay?" asked Gus, walking over to where Frank stood beside the tractor.

"Perfect. I even switched plugs to make doubly sure, and No. 2 still missed," answered Frank. "I've checked fuel, ignition, timing, and compression. They're all okay."

"In other words," said Gus, scratching his chin, "everything about No. 2 is perfect except she won't perk at anything above idling."

"That's about it, Mr. Wilson."

"Susie ever give you any trouble before?" Gus asked, turning to Mel.

Mel was silent for a moment. "Well, come to think of it," he finally replied, "she did run kinda rough when I first bought her a few years back. The dealer worked on her a bit, but as I recall she finally smoothed down of her own accord. I dunno, guess she was a little stiff or somethin'."

"Mind if I check the valve clearances, Frank?" Gus asked, taking off his dress-up coat and slipping on Frank's discarded jacket.

Valve Clearances Are All Okay

"Sure thing," answered Frank, holding out a set of feeler gauges. "It's a cinch I've slipped up on something."

"What's the clearance?" asked Gus as he reached for the gauges.

"The manual says '.011' on both intake and exhaust."

Mel and Frank watched while Gus removed the valve cover and proceeded to check the valves for No. 2. Evidently satisfied that they were okay, he made a quick check of the others.

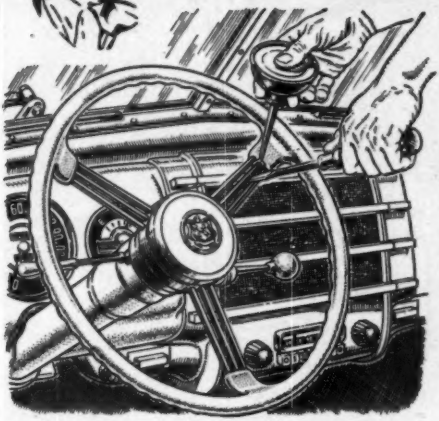
"No fault there," he announced. Then he hesitated for a moment and rubbed his finger over a spot on the engine block. "Humph," he grunted. "Got the valve wrench handy, Frank?"

Somewhat puzzled, Frank found the wrench in his toolbox. Gus took it and turned back to the engine. When he finally straightened up, he said, "Now give her a whirl, Frank, and let's hear how she sounds."

Frank climbed back up on the tractor seat and hit the starter switch. As usual, Susie started up with a pleasant purr.

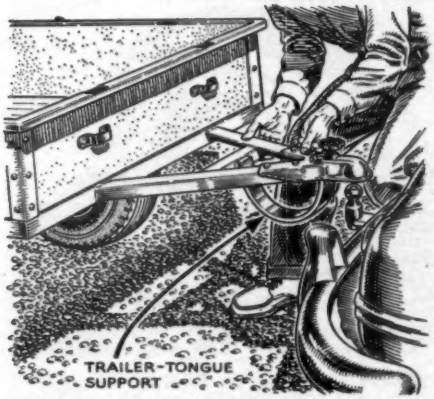
[Continued on page 244]

Hints from the Model Garage



Oil Quiets Wheel Squeaks. A few drops of brake fluid or rubber lubricant will stop squeaks in a banjo-type steering wheel. Insert a screwdriver as shown and pry gently to allow the lubricant to enter where the spokes join the rim.

Weight Loosens Rusted Bolts. If a wheel nut or bolt refuses to budge, adjust your jack to the same height as the nut, set the lug wrench on the nut horizontally, prop it on the jack, and apply your weight to the handle. Pressure, not kicking, does it.



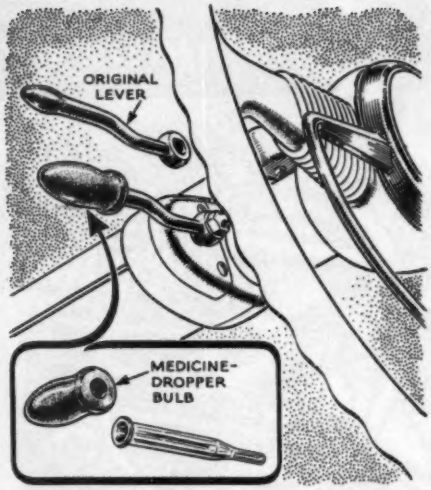
Guard Supports Trailer Hitch. A small trailer frequently doesn't have a support to keep the hitch socket free from mud and dirt when the trailer is parked. A piece of band iron bent in a half circle and welded or bolted to the tongue will give the protection needed. The loop should extend about 6″ below the tongue.

Slot Guides Battery-Water Level. In the past you were usually supposed to keep battery electrolyte just above the plates. But instructions are more specific for the latest batteries in GM cars. In these, you should add water to raise the level to a ledge at the bottom of a slot in the filler well. Don't fill above this.

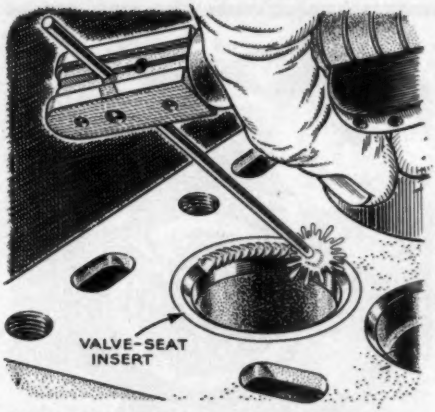
Turn the page, please, for four more auto hints.

MORE Hints from the Model Garage

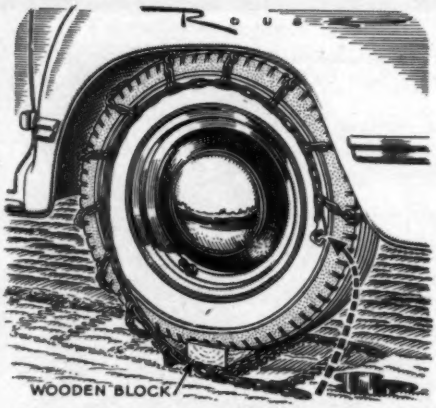
Handle Loosens Hot Cap. A 3" or 4" piece of iron rod riveted, soldered, or brazed to the top of a radiator cap will make it easier and safer to remove the cap when the radiator is hot. Locate the rod so it won't strike any other part of the car.



Bulb Forms Lever Grip. Some turn signals have a switch lever of such small diameter that your finger tends to slip off. William A. Brueske, of Wayzata, Minn., overcame this by shoving a medicine-dropper bulb over the end of the lever.



Weld Bead Loosens Inserts. Valve-seat inserts in truck and industrial engines are so hard and tough that attempts to remove them by drilling or breaking may damage the cylinder block. Such inserts can usually be removed with ease by running a weld bead around the valve-seating surface. Contraction of the weld metal shrinks the insert. Clean off any weld spatter from the top of the block or manifold passages.



Blocks Help Put on Chains. A couple of wood blocks carried in the car will make it easier to put on your chains. Lay the chains flat on the ground, place a block between one of the cross sections, and back the car until the wheels rest on the blocks. You can then pull the chains up around the tires and fasten them more easily. The blocks must be short enough so they won't hold the chain side strands.

The stained post indicates to Bill Canell that there's bad wood inside, which makes this wagon a poor bet. Despite his youthful appearance, Canell has had a lot of experience with station wagons. He runs one of the leading repair and refinishing shops near New York City.

Used Station Wagons Are Sometimes Bargains

But rot is hard to spot, and mileage is a poor clue to value.

By Bill Canell

PS PHOTOS BY W. W. MORRIS

IN ENGLAND, a station wagon is often called an estate car—a name suggesting shaded acres, a stately home, and lots of money. But there's often a station wagon in the one-car garage beside a GI house in America nowadays, because many families have found that it is the most useful kind of car for them to own.

Many persons who could not afford new station wagons have bought such cars secondhand. A wood body that has been well cared for will last for years. But so many owners fail to take care of their wagons that there are many lemons among the station wagons on the used-car market.

I run a station-wagon repair and refinishing shop in Jersey City, N. J., and I have often had to tell prospective customers that it would cost a small fortune to fix their wagons up because the bodies were too far gone—due to neglect. When moisture gets into the cracks, open joints, or rips in the roof fabric, all sorts of decay can result, and it is often more serious than the owners think.

A wagon that has been driven every day is likely to be in better shape than one that has stood for weeks in a damp garage—because the moisture will have been shaken out of it and dried up by the sun. So it pays to look twice at a station wagon that hasn't gone as far as its age would lead you to expect. It may be in worse shape than one with a much higher speedometer reading.

Neglect is costly. Wood bodies should be revarnished every six months. The best finish is the most dangerous, however, if the joints are not filled properly. Wood filler should be worked into all cracks and covered with a thin line of varnish. Otherwise water will enter them, be trapped under the heavy finish, and gradually eat away the wood.

Roof tears and small openings between the roof and molding should be sealed

promptly with weather-strip cement. Paint, wax, and varnish should never be used on fabric roofs, because they cause the material to crack. A light application of neats'-foot oil every few months will keep these fabrics pliable.

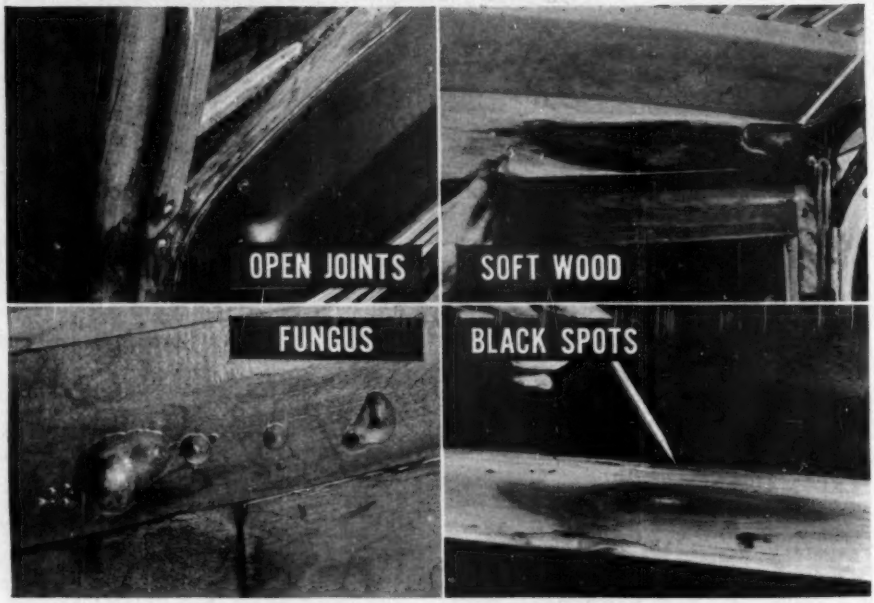
The drainage holes in the bottoms of doors and below sliding glass panes must also be kept open to preserve a wagon's body. This can be done quite easily by poking a stiff wire up through the holes occasionally.

Ominous signs. The wise buyer of second-hand station wagons is wary of:

- a musty smell,
- ugly fungus growths on the inside wood,
- and discolored wood either inside or out.

Any one of these signs of trouble may mean as much as $100 worth of work will have to be done on the wagon within a year.

Here are four defects that can make repairs costly.



Tips on sizing up the different makes.

EACH make of station wagon has its own good points and faults. When appraising different makes, Bill Canell keeps these points in mind:

1938-48 Ford or Mercury. If roof beams inside the wagon are almost black, they are far gone. Decay usually starts at the rear corners as a result of roof tears.

1949-50 Ford or Mercury. Seldom troublesome. One in a hundred may break out in serious discoloration, usually accompanied by peeling. Discoloring usually is found on center rail.

1946-48 Chevrolet. Look for water stains on rear-quarter glass rail (the horizontal member under the glass) and quarter section behind rear fender. Little danger of bad roof beams unless roof has been torn. A 1948 Olds may have similar trouble.

1942-48 Plymouth. Rear posts from roof down to glass rail may be bad. Rear-quarter glass rail and rear side-door glass rails often become waterlogged at ends. Rear roof beams are not expensive to repair.

1946-48 Pontiac. Rear posts often bad

Black or dark-green discoloration is usually serious, but gray areas along the top edges of horizontal frame members are not so ominous. The direct rays of the sun affect these edges most, and the gray spots usually can be bleached out and revarnished at any good station-wagon shop.

Decayed wood and patchwork repairs often are concealed by painting a wagon. Look carefully for any depression in the surface of such a body, and for cracks where there are no joints. Press those areas with your fingernail. If the wood is soft, and there are several such places, move on!

Look, too, for circular scratches such as an electric disk sander leaves. These machines can mar the panels beyond repair, but some owners and shops use them. For the best job, refinishing should always be done by hand. END

A leaking roof can cause much damage.

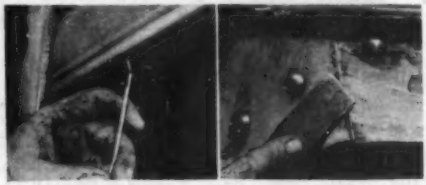
A tear in the roof fabric or a bad sealing job around the edges lets water in—resulting in unsightly damage like that shown in the photo above.

Rip away the fabric and you begin to see full extent of the damage. Rotted roof beam falls apart. The rear corner post also must be replaced.

Inside the wagon you often find dark wood too—a sign of rot. If water enters end grain, decay works toward both surfaces of the wood.

Weathered gray areas are sometimes found on the upper edges of rails, but these are harmless. Dark areas at left below are an example. Other photo shows how bleaching restores them.

Two maintenance points are shown below. Clean out the drainage holes in the rails and doors frequently. If joint opens, fill promptly with plastic composition wood to keep out water.



at lower ends. Open joints over fenders not serious unless accompanied by black spots. Look for fungus along door edges, especially near top hinge of front doors. Beware of wagon with many black areas.

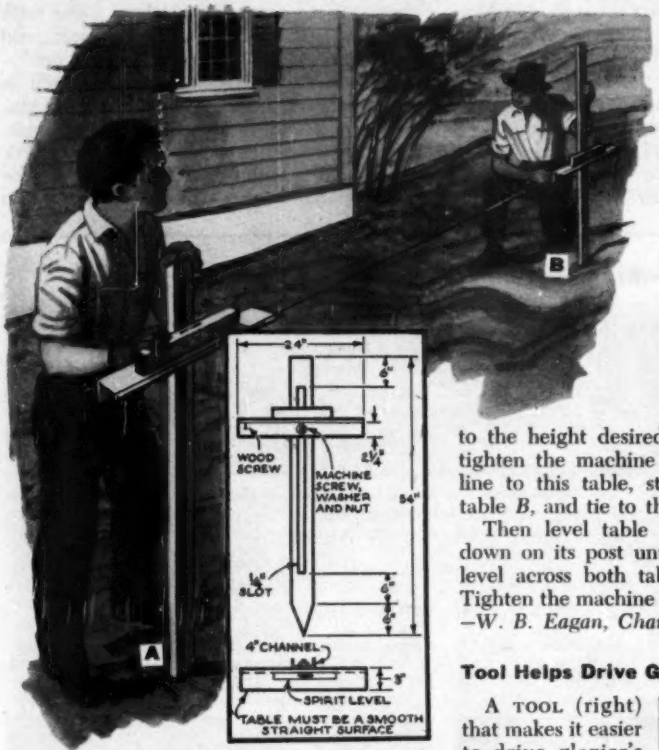
1946-48 Buick. Design of roof molding sometimes allows water to seep under roof material. Roof beams go quite quickly. Molding inside the body hides any sign of this. On entering such a wagon, check for a musty smell. Front-door posts frequently need replacement. Watch for long cracks in these. Also, open the doors and look for fungus near the hinges. A 1946 and 1947 Olds has same roof molding.

1949 Oldsmobile, Chevrolet, Pontiac. Construction of rear-quarter sections sometimes causes water to be trapped along glass rail near end of roof molding. Dark color and peeling results. Good refinishing with plenty of time for drying can prevent need for replacement of wood.

1949-50 Chrysler, Plymouth, Dodge, and DeSoto. Junction of rear post and glass rail subject to water penetration. Discoloration in end grain difficult or impossible to bleach. Check open joints.

1949-50 Buick. Lower end of rear post subject to warping and water entrance. This is difficult to repair.

Homemade Level Gets Foundations Off to the Right Start

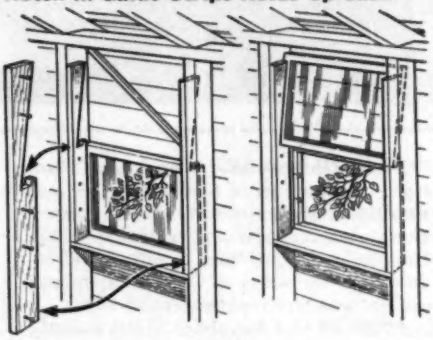


HERE'S a way you can level a foundation or wall without a transit. I have used the method on several occasions and find it gives very accurate results.

Make two posts as shown in the drawing at left, using aluminum channel or hardwood for the uprights. Drive these posts into the ground at the corners or ends of the distance you want to level. Adjust table *A* on its post to the height desired, level the table, and tighten the machine screw to hold. Tie a line to this table, stretch it tightly across table *B*, and tie to the screw on the latter.

Then level table *B* and slide it up or down on its post until the line lies exactly level across both tables, without bending. Tighten the machine screw to hold the table. —*W. B. Eagan, Charleston, W. Va.*

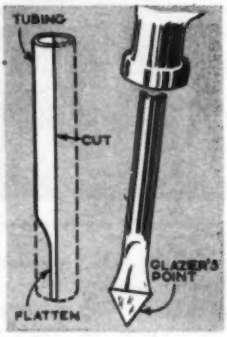
Notch in Guide Strips Holds Up Sash



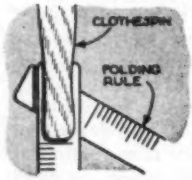
GUIDE strips cut like those above will let you keep up a single window sash in a garage or other outbuilding without a prop. Nail the strips in place with the sash resting on the sill. Allow about ⅛" play between the sash and strip. The sash can be locked shut by placing a stick above it as shown at left above.—*Walter F. Dierken, Dayton, Ohio.*

Tool Helps Drive Glazier's Points

A TOOL (right) that makes it easier to drive glazier's points can be made from a 2" length of copper or brass tubing. Cut the tubing lengthwise and flatten one end. Place the flat end against the point and tap lightly.—*Victor H. Lamoy, Upper Jay, N. Y.*

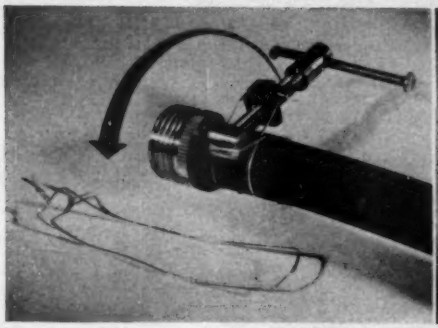


Clothespin Keeps Rule at Angle

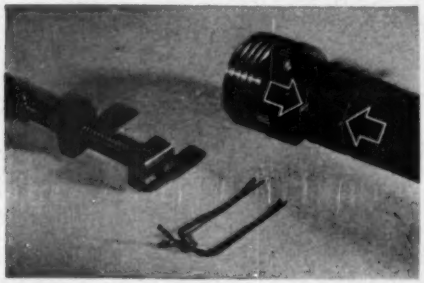


IF YOU have no bevel square, you can transfer angles with a folding rule. After setting the rule at the desired angle, you can keep it more nearly rigid with a clothespin over the joint.—*H. O. Schoenfisch, Mountainside, N. J.*

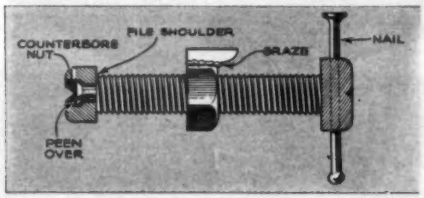
Homemade Tool Cinches Wire Clamp Tight on Hose Fitting



Form long loop of iron wire, twisting ends with pliers. Loop around hose and catch on both nuts as above. Tighten by turning the screw. Then swing the whole tool over the lower nut (above), until the bent loops close and wire slips out of groove in lower nut.



Cut away wire close to hose (arrows) at both sides. Tap the cut ends flat against the hose.



ARE the couplings or nozzle on your garden hose securely clamped? Here's a way you can make them so—before the lawn-sprinkling season arrives.

The homemade clamp shown cinches a neat double loop. Unlike the usual pliers-twisted loop, the ends are short and leave nothing to catch. If made with fair-sized iron wire, the clamp holds very securely. The method is also good on welding or air hose if you're short a regular clamp.

The tool is made from a bolt. File or turn down a shoulder on the end. Run on a nut to which is brazed a piece of metal to form a hook (or file the nut to a hook shape). Find a smaller nut that will slip on only to the shoulder, counterbore the hole in it, and peen over the bolt end to retain this nut, like a swivel foot on a C clamp. File a groove across the nut to hold the wire. Drill the bolt head for a nail or bit of rod to serve as a T handle.—*L. W. Sult, Berwick, Pa.*

Plumber Can Carry "Snake" Coiled Inside Tire Casing

I SAW a plumber using this gimmick to carry his snake—the long, flexible wire used to open clogged drains. He cut the bead out of one side of an old casing and coiled the snake in the casing. Removal of the bead relieves some of the tire's stiffness and permits the snake to be coiled in and out easier.

With the snake in the tire, he can carry it in his truck without the wire tangling. And when he's at the job, he can roll tire and snake to the place he needs it.—*E. F. Lindsley, North Prairie, Wis.*

Before the author went to work, his 16-inch television set looked best in a dim light.

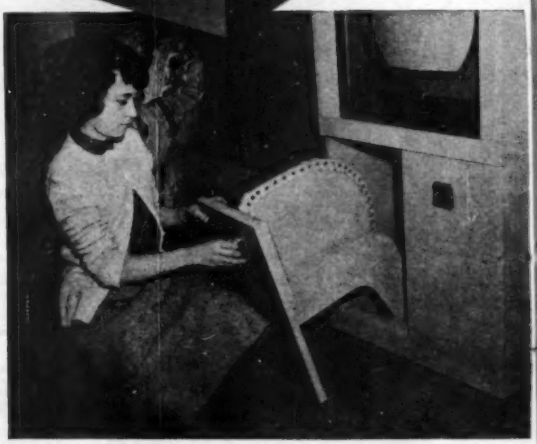
After he put it in a new cabinet, he was glad he had bought an inexpensive table model.

Seats Built Into TV Set

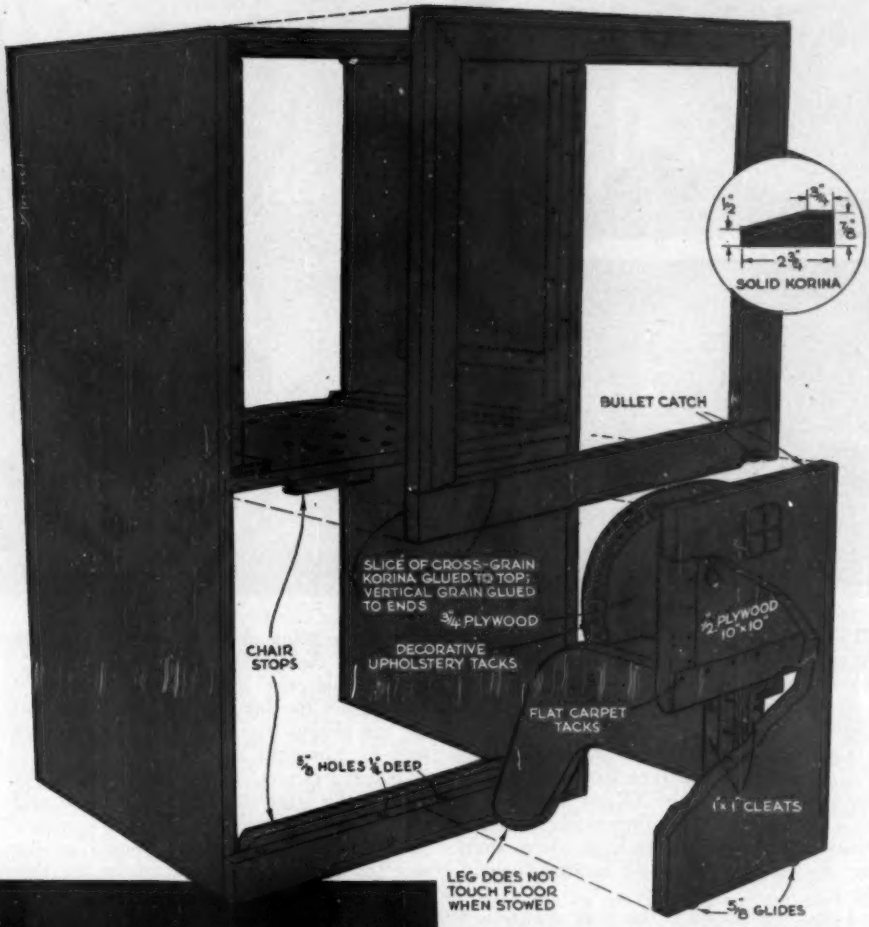
Extra chairs can be stowed in this homemade cabinet for a table model.

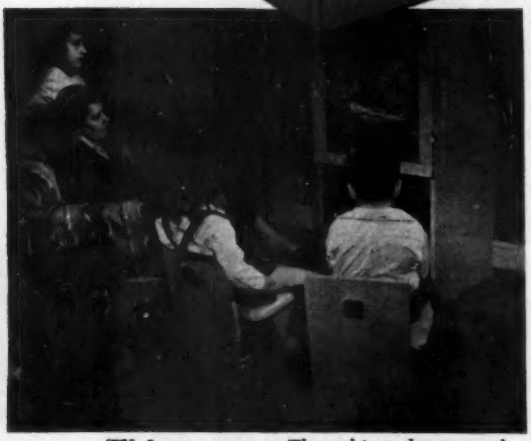
By Herbert Pfister

PS PHOTOS BY W. W. MORRIS



Someone coming? Two extra chairs can be pulled right out of this modern TV cabinet.





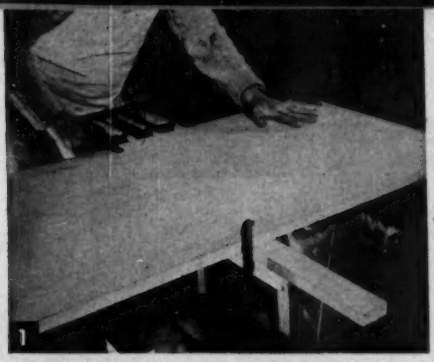
TV for two more. The cabinet doors are the backs of the two upholstered folding chairs.

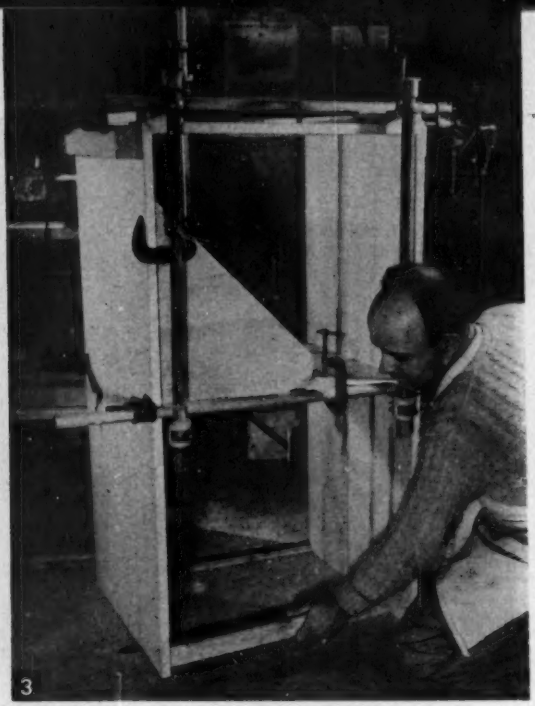
THE designers of television cabinets must think that everyone lives in a palace. They've not produced a suitable model yet for a home like mine, where every inch counts. So I bought the simplest table model that I could find and built my own cabinet —with hideaway seats.

Now we never have to run upstairs for another chair when the neighbors' children drop in. We have two guest chairs right in the cabinet. And when our guests depart, we simply shove the chairs back into the set.

It's a console that anyone the least bit handy with tools can build. It looks as trim as a factory-built job. And you can slide a table model into it without doing anything whatever to the original set.

My set was a 16-inch RCA, 21" high,





21½" wide and 20" deep. But I made the recess into which it slides slightly larger, leaving an extra ¾" at the sides and above and below the set, and an inch of additional depth.

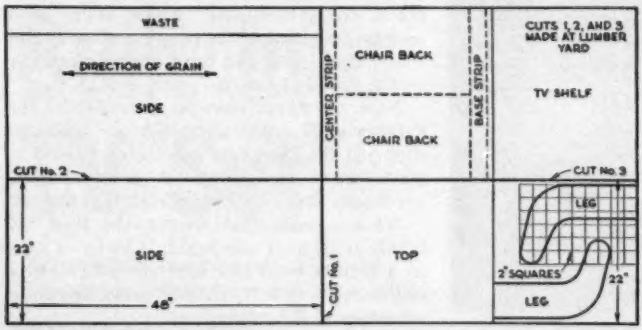
Cabinet details: After examining various cabinets in the stores I concluded that the shelf on which the TV set rests should be 24" from the floor. I then worked out my plans so as to get all my large pieces from one 4' by 8' panel of ¾" korina-veneered stock.

I did this to keep the cost down, but found it also enabled me to be sure the grain would run in the right direction in all of the pieces. By going about the job in a similar way, you can have the big panel cut to manageable size before you trundle it home from the lumberyard. But yard cuts are not always true or smooth, so allow an inch for trimming.

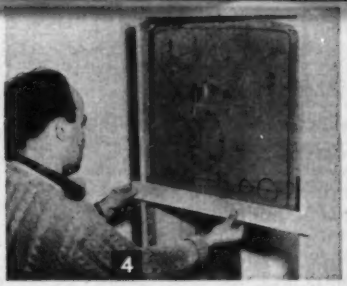
Figure 1 (above) shows how I mitered the tops of the large sidepieces. Near one end of each piece I scribed a miter line square with the edge of the stock. Then I set the saw for a 45° cut and measured the distance from my saw blade to the side of the saw table. Exactly the same distance in from the miter line I clamped a guide strip to the work. This strip bore against the side of the table as I fed the work through the cutter.

I put the sides and top together and trimmed the center shelf to fit. Then I dadoed the shelf into the sides as shown in Fig. 2. But before gluing the shelf in, I drilled a liberal number of vent holes in it.

I glued and clamped the pieces with great care (Fig. 3), and when the glue had set,



Here's how the necessary pieces were obtained from a 4' by 8' panel.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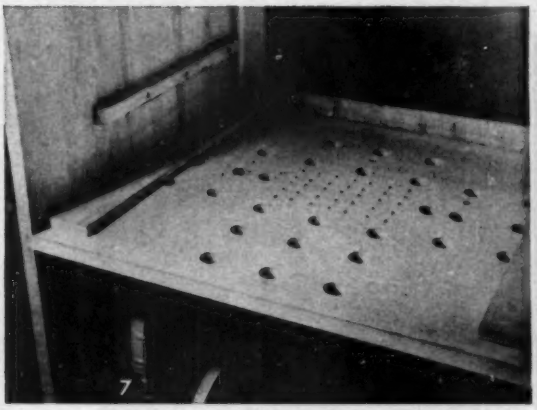
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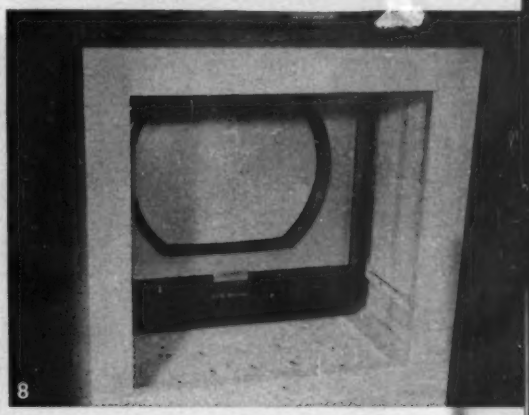
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I reinforced the joints by gluing a strip of quarter-round in each corner.

If you don't have enough large clamps you can still get a pretty clean joint by screwing a long, square cleat in each corner. Drill pilot holes through the cleats, sides, and top. Brush on the glue and screw the cleats in place to pull the corners together.

Make a template. To avoid having to lift the set repeatedly to fit it into the cabinet properly, I cut a cardboard template and accurately marked the picture-mask outline and knob positions on it (Fig. 4). This helped me determine the correct position for the center cross strip. Once this was established, the location of the door panels and bottom strip followed simply (Fig. 5).

You can use a ready-made picture frame for the cabinet mask, or build one as I did. My frame is three-sided and has mitered corners at the top (Fig. 6). It butts against the center cross strip and is flush with it on the inside but chamfered on the outside.

To get the chamfer effect, I had to use solid korina for the top and sides of the frame. Then I cleated it to the cabinet from the inside.

The loudspeaker is on the top of my set, so I sawed out an appropriate speaker opening in the top of the cabinet. I made a simple wooden frame to fit the opening, tacked a piece of radio grille cloth over the frame, and bradded the frame into the opening and flush with the top.

Figures 7 and 8 show additional details of the completed TV shelf. The ¾" slide rails in the two lower corners hold the set level (I didn't think the rubber cabinet bumpers were stable enough). For side-to-side alignment, I used ¾" side rails, rounding the corners, sanding the rails smooth, and countersinking the screws. These make it possible to slide the set out for servicing and be sure it will go back in exactly the same position.

The chairs: A finished chair frame—the right-hand one—is shown in Fig. 9. Note that the door panel and the curved center leg are so joined as to tip the chair back a couple of degrees. This puts most of the weight on the squared rear support and makes the chair more stable.

The door panels were cut to fit the lower opening and are held in place by furniture glides and bullet catches as shown in the construction drawing.

I made each seat from a 15" square of ¾" plywood, rounding the front corners so the seat would clear the cabinet when tipped in and out. I cut a pad of 1" foam rubber and a sheet of upholstery plastic, and assembled the layers as in Fig. 10. The covering plastic tends to stretch, so you have to

draw it taut as you tack it to the underside of the seat (Fig. 11). Flat carpet tacks should be used on the part that lies against the hinge board.

Each seat is hinged to its frame parallel with but 2" away from the back panel (Fig. 12). A cabinet catch keeps the seat upright when stowed. And a screen-door hook keeps it from tipping accidentally while it's in use.

Backs for the chairs were made from 10" squares of ½" plywood. Two keyhole slots (Fig. 13) were drilled and sawed in each back so that it could be hung on two round-head screws.

The finished chairs, neatly stowed in the cabinet, are shown in Fig. 14. END

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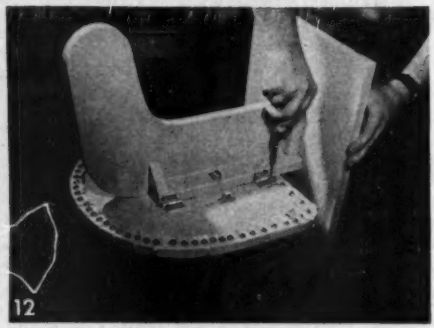
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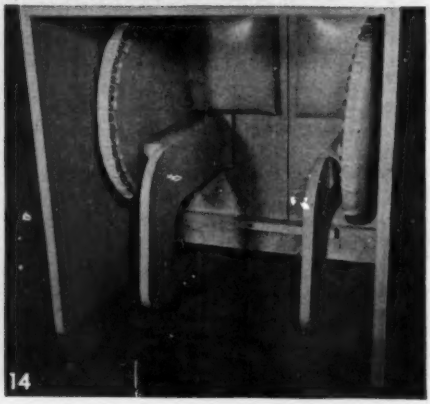
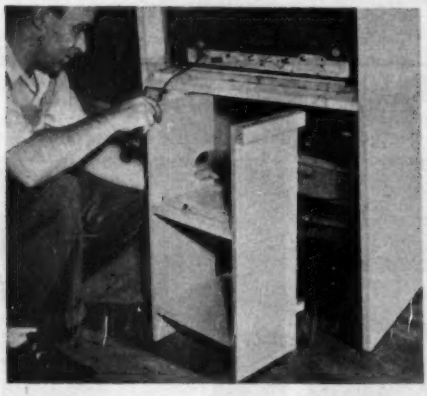

14

There's Also Room for a Record Player and Albums

AFTER building his TV cabinet, as described on the preceding pages, the author found that there was room enough not only for chairs but also for a 45-r.p.m. phonograph and albums. Here's how he tucked them out of sight. He cut a two-shelf ladder arrangement out of ½" stock and made a large opening in one side so that he could reach the wheel-type on-off switch. The player is connected to the phono jack.

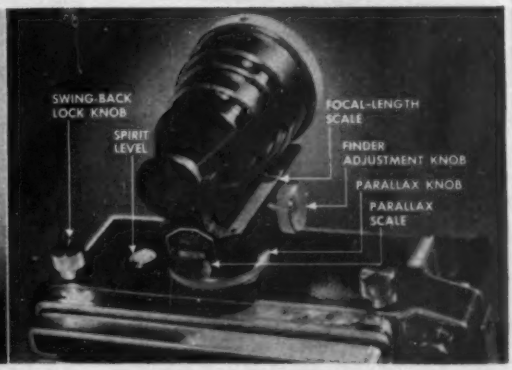


Rolls-Royce of Press Cameras Sports New Optical Finder

AT THE turn of a knob, the viewing field of the new optical view finder on the camera shown below shrinks or expands to suit lenses of various focal length from 90 mm. to 360 mm. It's made for the Linhof Super Technika, a de luxe German camera.

Another knob corrects parallax. The finder's front-lens mount turns to match the rectangular field to the revolving camera back. In action shots, you can see the subject about to enter the picture field.

A longer-base range finder on the redesigned Technika assures utmost accuracy in focusing. Interchangeable coupling cams, now made in America, synchronize the finder to as many lenses as desired. Kling Photo Supply Corp., New York, distributes the camera and its accessories.



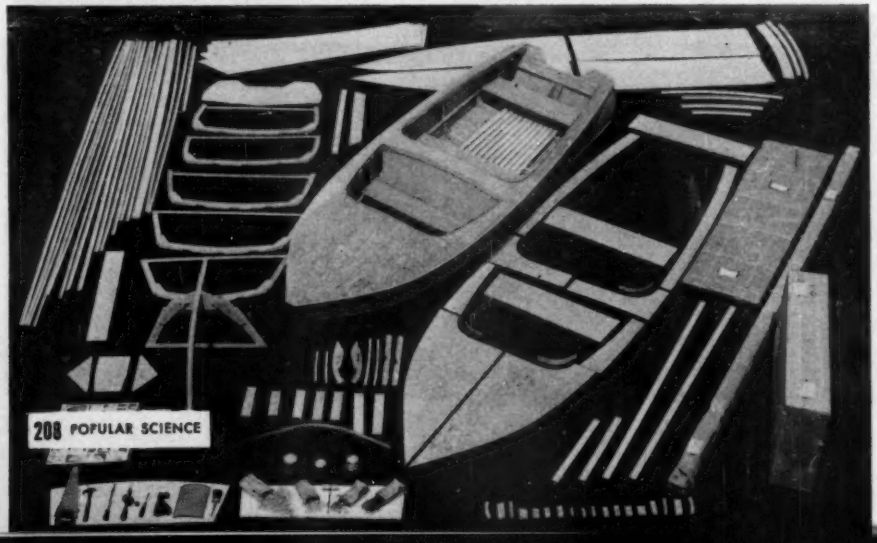
This 65-lb., 8′-long pram—built from a kit sold by Hagerty, of Cohasset, Mass.—can be converted to a sailing pram with an additional kit made by the company. The parts, screws, oarlocks, seam compound, assembly form, and instructions are shipped in one package.

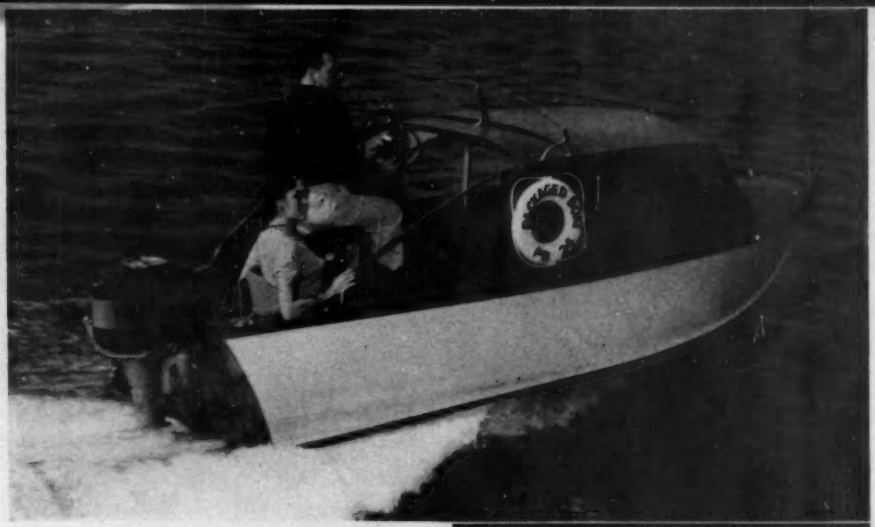
What's New in Boat Kits

YOU often can save yourself time and money by assembling your own boat from a kit. Besides pre-cut parts, screws, and seam compound, most kits include easy-to-follow plans. Sizes of the boats you can assemble from kits range from little prams to cabin cruisers with inboard power plants. Most models are designed for outboards.

Two popular models made by Chris-Craft Corporation, of Algonac, Mich., are the 21′ cruiser (above) and an 8′ sailing pram (right). Other models range from a 21′ inboard runabout to the 8′ pram without a sail. The same hull kit is sold for the 21′ cruiser and the 21′ runabout. Other kits add the cabin and flying bridge to the hull.

Here are all the parts, tools, and hardware (below) needed to put together a 15′ 4″ boat. Kit is shipped in the three packages shown at right in photo. The manufacturer, U-Mak-It Products, of New York City, also offers 20 other models from 8′ to 23′, including cabin cruisers.





On test runs, the cabin cruiser pictured above hit 33 m.p.h. when powered by a 25-hp. outboard. The kit that yields it (right) is priced at $330 by Marine Mart, Buffalo, N. Y. Specifications include: length, 16′; beam, 68″; cabin headroom, 48″. Two 8′ bunks are in the cabin. Kit includes pre-cut oak parts, pre-assembled oak frames, full-length marine plywood panels, and screws and glue. This cruiser and the company's 22 other models can be bought as kits, or as semi-finished or finished boats.

Mahogany plywood is featured in two kits sold by Bay State Boat Co., of Boston, Mass., including the 12′ runabout shown above. Bottom, sides, deck, seats, and transom are mahogany plywood. Other parts are oak. Assembly is the same as with the company's fir-plywood kits.

This V-bottom runabout—built from a kit sold by Roberts Industries, Inc., Durham, Conn.—was hitting 42 m.p.h. when the photo above was taken. The boat is 11′ 7″ long with a 53″ beam. The company manufactures eight other kits for boats from 8′ to 14′ in length.

Hulls like the one pictured below can be bought ready-cut or finished. The maker is the Acme Boat Co., of Miamisburg, Ohio. The 13′ boat shown here will do 50 m.p.h. with a 25-hp. motor, according to the company. Another new kit provides a hull 9′ 6″ long with a 49″ beam.

Latest addition to the line of prefabricated boats made by Ozarka, Inc., of Woodstock, Ill., is this 11′ 7″ hull with a 51½″ beam. It is available in two models—one with side panels of fir marine plywood and the other with side panels of mahogany marine plywood.

Anyone now can make plainly visible the vapor trails of atomic particles emitted by the radium dial of his wrist watch.

How to See Cosmic Rays in Your Kitchen

By Kenneth M. Swezey

By turning a peanut-butter jar into a cloud chamber, you can observe the rays that mystify the experts.

IN A few minutes you can build yourself a cloud chamber and see the vapor trails of:

- Mysterious cosmic rays, bombarding the earth's atmosphere from outside space.
- Atomic explosions from radioactive ores such as Uncle Sam wants.
- Particles emitted by disintegrating atoms in the radium dial of a wrist watch.

Suggested by scientists at the Brookhaven National Laboratory, this homemade "showcase" works better than some of those sold for students' use.

What you need—a widemouthed jar, black velvet, felt weather strip, alcohol, dry ice.

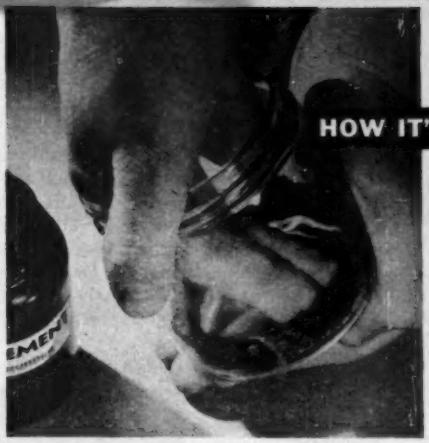
The secret of any cloud chamber is a supersaturated vapor. As atomic particles dart through this vapor, they condense molecules in their path, leaving visible droplets—like vapor trails of high-flying aircraft.

In this chamber, supersaturation is produced by causing warm alcohol vapor to diffuse downward through a layer of air chilled by dry ice. At some point within the layer of air, the vapor becomes supersaturated.

For the chamber, choose a widemouthed jar, with a rubber ring in the cap. Any of the common alcohols (ethyl, methyl, or propyl) will do. To steady your cloud chamber, and make the dry ice last longer, fill a coffee can with sawdust or cotton. After completing the setup, warm the jar bottom for a minute with your hand.

In a moment you should see straight shafts and zigzags of vapor—trails of mighty forces let loose from outside our world. To see the vaporous signatures of beta and gamma rays from exploding radium, just hold a luminous watch dial near the jar.

HOW IT'S MADE



1 **Cement weather strip** around the inside of jar next to the bottom. Use rubber cement

2 **Cement black velvet** strip around inside of jar mouth. Black will help you see the rays.

3 **Cement a disk** of black velvet to underside of the jar cap to complete dark background.

4 **Pour in enough alcohol** to saturate the felt strip and leave ¼" in the bottom of jar.

5 **Close cover, invert jar,** and rest it on a can of cotton in which you have put dry ice.

6 **Shine beam** of slide projector through jar and you'll see cloud trails of cosmic rays.

Combination Hanger Protects Several Fragile Garments

A WOODEN hanger, notched at intervals and fitted with wire hangers, as at left, will hold five or six light garments. It's fine for hanging up ruffled blouses or children's dresses that are easily crushed when jammed together on separate hangers. Or, hooked over a shower-curtain rod, it will hold lots of laundry.—*V. H. Lamoy, Upper Jay, N. Y.*

Blunt Nails Used on Green Wood

UNSEASONED wood sometimes splits when nails are driven into it. Blunt the points of the nails, as shown at right, against an old wrench or other flat piece of metal. This helps to prevent injury to the wood.—*R. F. Donovan, Guttenberg, N. J.*

Hairpin Makes Oiler for Tiny Parts

A FINE hairpin makes an ideal oiler for small parts where just a drop of oil is needed.

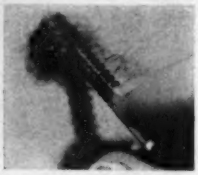
Twist the two legs of the pin together, leaving a small loop at the end to convey the oil. The twisted ends of the hairpin, forced into a cork, provide an ideal handle.—*Victor Lamoy, Upper Jay, N. Y.*

Plunger on Drill Protects Hand

A MISS when you are drilling through concrete with a star drill can cause injury to the hand holding the drill. Try slipping the heavy rubber suction cup of a small sink plunger over the drill as at left. It will deflect the blow if you miss, rendering it harmless.—*L. Hochman, Sherman Oaks, Calif.*

Steel Wool Holds Screws in Plaster

SCREWS driven into a plaster wall often chip out the surface and pull free. But if a hole is first made in the wall with a drill or nail, and packed with steel wool before the screw is driven in, the screw will be gripped by the steel wool with surprising firmness.—*R. F. Donovan, Guttenberg, N. J.*



Tiny Clamps for Glued Work

HOBBYISTS often have to glue or cement together delicate, tiny parts that can't be held in a vise or clamp while they are drying. Ten-cent earrings (right) will firmly clamp ship-model parts such as railings and bulwarks, plane fuselages, and laminated bits of plastic for jewelry. Bobby pins and the tiniest spring-action hair curlers are also good for this work.—*J. J. Rea, Urbana, Ill.*

California Cut-Out Chairs Cut the Cost of Comfort

They're made of plywood, clothesline, and curtain poles—and designed for mass production at home.

By Mark West

YOU can mass-produce this chair in your home shop. It was designed for California's climate and outdoor living, but you'll find it comfortable anywhere—in your dining room, breakfast room, or porch.

Building it is a cinch, but it took two of us quite a lot of time to design it and work out the details.

You can cut out and assemble several at a time. Sawing the first one out of plywood does part of the cutting for the second one, and so on. This means that you can slice the parts out of plywood like peeling layers off an onion, and with little waste.

By building several at a time, you can turn them out for less than $4 each. That is less than you probably would spend for webbing or upholstery alone if you built other types of chairs.

The chair is strung with plastic clothesline—the kind that's sold in hardware stores. The line costs less than webbing and is made

How the inviting chair in the photo below can be cut is shown at left. Template at top is for legs. After marking around the arm template, move it until ends of tabs touch lines previously drawn.

to withstand sun and rain. Cleaning it is easy. Just wipe it with a damp cloth.

Here's what you'll need per chair:

- Three-quarter inch plywood; about 4 sq. ft. for each chair.
- Three 19" lengths of 1¼" pole.
- Wood screws, six 1¼" and six 2½".
- Plastic clothesline, about 60'.
- Glue, sandpaper, and paint.

Making the templates. These will simplify your chair building a great deal. Lay out 1" squares on heavy cardboard, pressed board, or thin plywood. Transfer the shapes shown in the drawing on the opposite page and cut out the templates.

Experiment with the templates on the panel you will use to get the most efficient arrangement. (The photos and drawings show a layout for cutting eight sets of chair parts from a 4' by 8' panel.) Note that the template for the sides and back has two spacer tabs; if you move the template so that the ends of these tabs just touch the previously drawn line, the layout gives a common separating line between two pieces.

After you have cut out the parts, sand them smooth. Clamp two or more matching pieces together and drill the ¼" holes.

Cut the pole into 19" lengths. This gives a rather wide chair—the kind you'd want on a terrace or porch. If you want the chair more compact—for a dining room—cut the pole into 17½" or 18" pieces. Drill blind holes in the back pieces for the poles—one at each end and one in the middle. The positions of the blind holes are shown in a photo on this page. Drill the ¼" holes in two of the poles, and ream them slightly with a countersink.

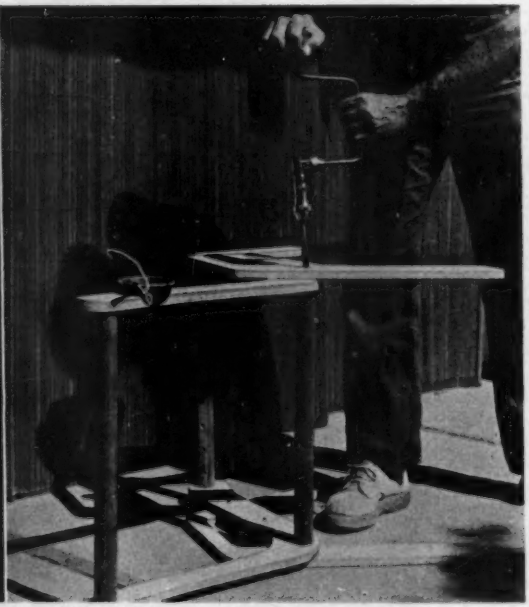
Assemble the chairs with 2½" screws into the poles and 1¼" screws to hold sides and backs together. Fill over the screw heads with composition wood and sand the chairs.

Since you are going to string the chairs with white cord, a loud-color paint—bright red or green—is best.

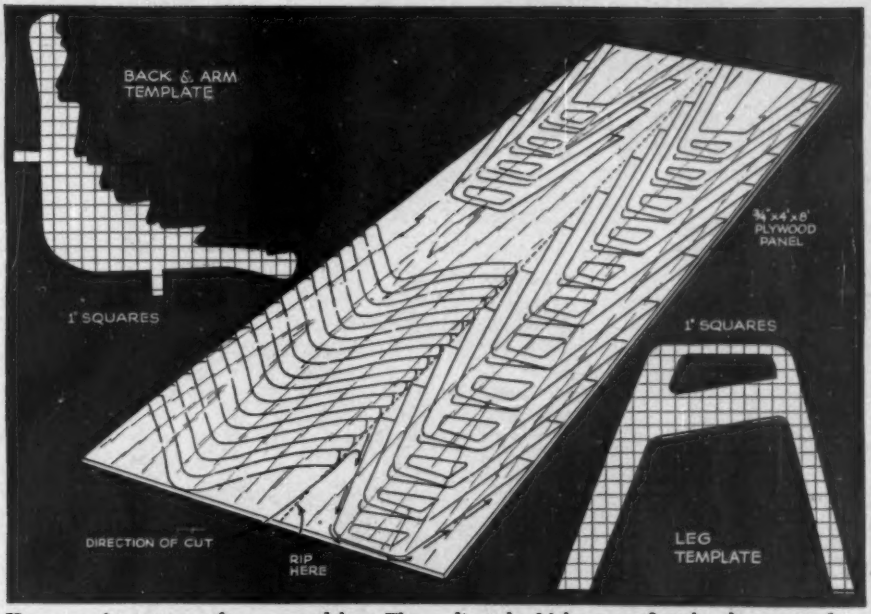
After painting, string the chairs, as shown in the two photos on the opposite page. When you put in the up and down strings, weave them over and under the cross strings the way a basket is woven.

As you go along taking up the slack, wedge an ice pick in the hole you've just pulled the line through. The ice pick will hold the line tight while you work on the next section of line. END

Screw back pieces to leg pieces with the screw heads on the inside, as shown above. Only two poles are drilled for the clothesline.

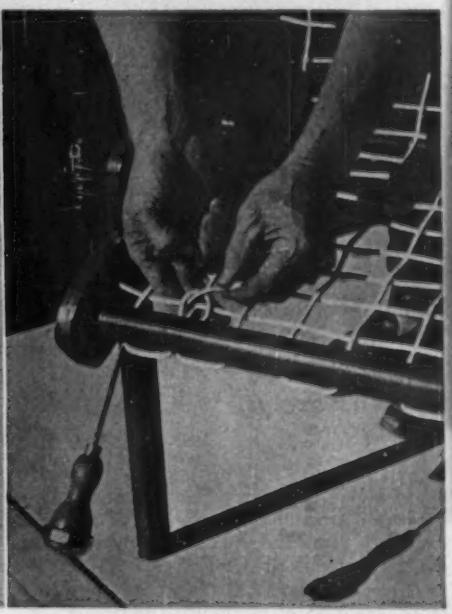


Assemble the parts with screws and glue. Countersink the screw heads and cover them with composition wood. Sand before painting.



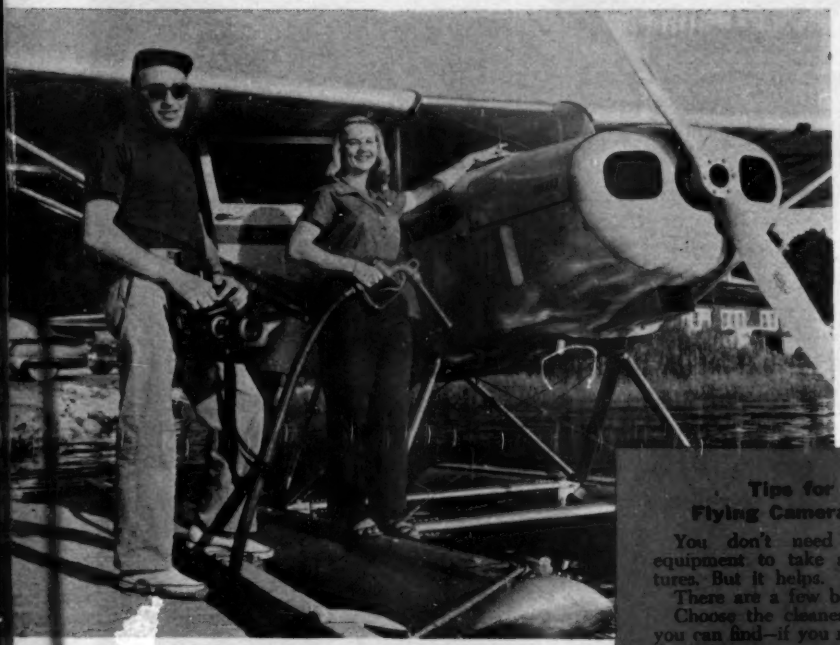
Here are the patterns for arms and legs. The layout on the plywood shows you the cutting sequence. Start by ripping the panel where indicated. Make your first bandsaw cuts from this end of panel. Arrows on the layout of the leg pieces show you the direction to make cuts.

Knot line and pull it into counterbored starting hole. Take up slack to finish hole. Bring end through hole below finish hole and knot it.



Ice pick wedges line taut while you thread it through holes. Photo above shows you where to knot line at end of up-and-down stringing.

Photography Pays for My Flying



Here we are. The girl is Nonnie Horton, my co-pilot. She handles the plane while I'm shooting pictures. On a plane like this Piper Pacer, I usually remove one of the doors to provide plenty of camera room.

Tips for Flying Cameramen

You don't need precision equipment to take aerial pictures. But it helps.

There are a few basic rules: Choose the cleanest window you can find—if you must shoot through one.

Keep your camera and your arms free of the plane while shooting, or engine vibration may shake the camera enough to fuzz the picture.

Use a fast shutter speed and focus the lens at infinity.

One hobby supports another—and has taught me a few things that everyone who uses a camera should know.

By Ben Kocivar
Manager, "Air Pixies," New York

"AIR PIXIES" is a growing and profitable aerial-photography business. It began as a cartoon doodle on a luncheon tablecloth two years ago. It is still a sideline for me—I only work at it on week ends—but it pays for all of the flying I have time for, and is an example of a hobby turned into a means of making money.

The idea came to me when a friend asked whether I would take some air views of his farm. I went up with my Contax II one sunny afternoon and, after spotting his property lines from a sketch he had provided, banged away.

The tiny 1" by 1½" contact prints could show little, I knew. So I made three 16" by 20" blow-ups, dry-mounted them on heavy illustration board, and had them carefully spotted. Then I wrapped them up with a fancy string and paper and delivered them with all the ceremony of a big-

Homeowners pay for shots like this. I waited until a cloud passed over the sun, giving even, flat lighting. A K-2 filter helped bring up the contrast. Exposure was 1/400 sec. at f/5.6.

time advertising agency presenting a major campaign.

And was he pleased! I can't remember now who was more pleased—my friend with the handsome views of his property, or I with the heart-warming recognition they got. I felt like an actor getting seven extra curtain calls. And the next day my friend mailed me a check for $50.

That did it. From then on I was a professional aerial photographer. Two other orders came in promptly from people who saw this first job. Later I invested in some advertising and Air Pixies became a growing concern.

Pictures of a man's house and property, I was to learn, run second in his heart only to shots of his newest offspring.

What camera to use? Looking back at my first crude efforts, I shudder slightly. Handy though a 35-mm. camera may be

in a small place, it is still far from ideal for making big, detailed air views. Even with fine-grain film and careful development, grain is a problem in extreme enlargements and spotting is a genuine nuisance. I tried several aerial cameras but found them too bulky. There just isn't much room in a small ship.

I finally came back to an old faithful standby, my 4" by 5" Speed Graphic. I now use this with special lens-extension tubes so the camera bellows does not get caught in the wind. Three lenses go with me on all flights. One is the normal 5¼" Kodak Ektar. Second is the war-surplus 7" f/2.5 Aero Ektar formerly mounted on a K-24 aerial camera. Third is a 12" f/4.5 Dallmeyer telephoto.

The lens used in each case depends on the type of job and the altitude restrictions. Over most towns, planes are not permitted under 1,500 feet. That's where the long lens comes in handy.

Avoid using film packs. High-speed panchromatic film loaded in film holders is what I prefer. Film packs, I learned the hard way, often pick up just enough flutter from engine vibration or the blast of air to go out of focus in spots. I never use them for aerial work. I frequently use a yellow filter for extra contrast. In addition, I shoot to underexpose slightly and then overdevelop in order to increase the contrast even more. This is necessary because most landscapes, particularly in the East, lack sufficient tonal contrast to yield a snappy print. In the midwest and far west where the air is considerably less polluted by industrial smoke, however, the ground often provides good contrasts.

Average exposures on a bright day with the sun behind the camera are made at f/8 at 1/400 second. Often for a special scenic effect I shoot into the sun for that wonderful backlighting that makes water sparkle and outlines land contours. To compensate for this I usually open two stops.

But I don't recommend backlighting shots when the customers want housing details. They're liable to complain if they can't count every shingle on the roof—and you can give them that if you're careful.

High wing shades camera. Almost any high-wing light aircraft can be used. I like a high wing because it shades your camera from the sun and you don't have to bank as steeply as you do in a low-wing ship. Piper Cubs and Aeronca trainers are

A farm photo always tells its own story about the planning and work of the owner. Prints of this one were ordered for use in a catalogue. It was shot from 800 feet at 1/400 and f/5.6.

particularly good because of their slow-flight characteristics. On Cubs I open the whole right side in flight. On Aeroncas I remove the big right-hand door and just make sure my safety belt is secure. Incidentally, it's a good idea to have a strap holding the camera, too. The strong slip stream as you lean from the plane or a gusty bump can jar it from your hands.

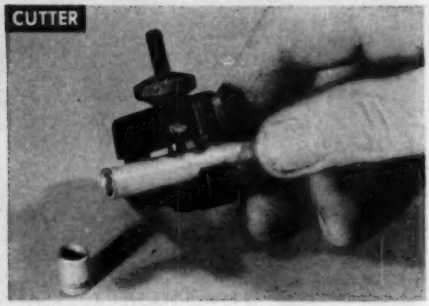
How I make a photo run. I started my business by doing both the flying and photography. But I learned that to do each properly at low altitudes takes concentration. Now an old friend, Nonnie Horton, a former WASP pilot, usually flies with me. We have learned to work as a team. Our technique is for me to line up the ship for the photo run. Then, as we approach our target, Nonnie takes over but I keep my feet on the rudder pedals. By gentle pressure I indicate whether we should alter course right or left.

Working altitudes vary from 2,000 feet for large tracts of land to 10 feet for low-level shots of yachts.

There's no fortune in aerial photography. I knew one man who dropped $20,000 in salaries and equipment before giving it up. But it can be a good small sideline. END

Boat owners like air shots too. For this one we swooped down to 100 feet and made the shot at 1/800 and f/5.6. Note the backlighting. For over-water shots we always use a float plane.

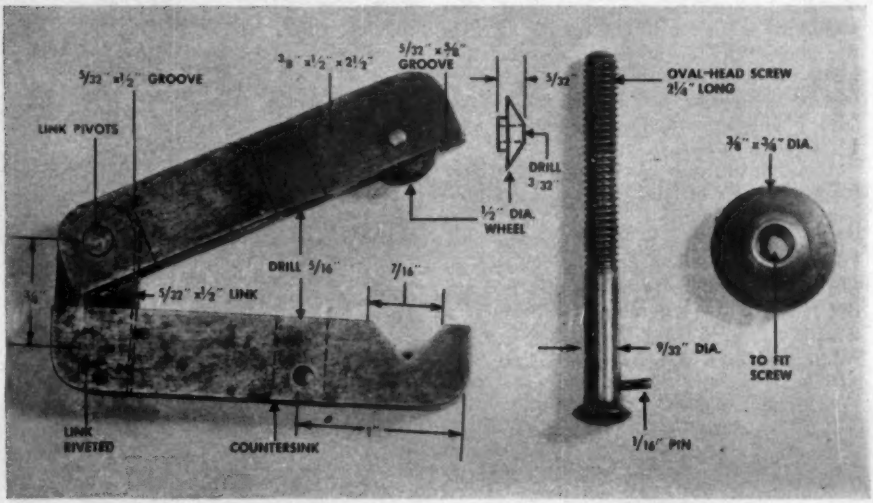
Public buildings often present an interesting pattern. Here light stone buildings and concrete walks and drives reflected light and made it easier to get a photo with lots of detail.



Tube-Fitting

A cutter and flarer will be useful in any workshop or serviceman's tool kit.

CUTTING and flaring a piece of tubing may sound simple—but without the proper tools you can go badly wrong. These tools will do the job right. The cutter auto-



ANNEALING TUBING

As it ages, copper tubing usually hardens. When bent or twisted, it also tends to work-harden. To soften it for easy use and to make it less brittle, annealing is necessary.

In heating the tubing, keep in mind that copper melts at about 1,900° F. If you use an oxyacetylene torch or other hot flame, be careful not to overheat it or you may burn a hole in the tubing. Heat to a dull red color and then cool in water. You can use air cooling, but water cooling has a tendency to brighten the copper and remove some of the oxidation that may occur during heating.

Although aluminum tubing seldom hardens like copper, it is sold in various grades of hardness, and you may wish to anneal a particular grade. Use the same process as for copper, but be doubly careful not to overheat. Aluminum melts at about 1,217° F., and if overheated, tubing may collapse.

FOR YOUR POPULAR SCIENCE INFORMATION FILE

Tools You Can Make

FLARING TOOL

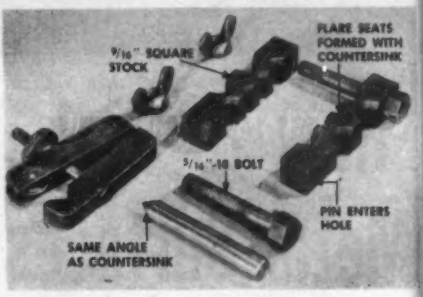
matically gives a square cut, which is more than can be said for a hacksaw. The flaring tool can be built to take six different tubing sizes.

Flaring tool. Drill square stock for the clamp bolts. Then drill holes through the bolt heads for the pins that keep the bolts from turning as the wing nuts are tightened. Use these holes to spot slightly larger holes in the square stock.

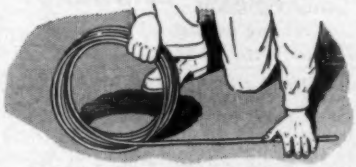
Clamp the parts together, lay out the desired flaring seats, and drill holes the diameters of the tubing to be handled. Center the drill on the line between the halves. Form the flare seat with a large countersink. Later, if the tubing doesn't clamp tightly, file a bit off the mating faces of the square members. Turn the punch from drill rod to the same angle as the countersink used for the seats. Hardening is optional.

Cutter. Mill, or saw and file, grooves 5/32" wide across three ends of the two legs. Cut a 90° notch across the fourth. Cut out and rivet on a connecting link to the notched leg. Round off the other end of the link and enlarge its rivet hole to let it pivot freely. Clamp the legs parallel and drill 5/16" holes in them for the pinch bolt, which should be a loose fit. Fit a pin to keep the bolt from turning.

The thumbscrew is a knurled turning, ⅜" thick, tapped to match the bolt. Turn the cutting wheel from drill rod. Harden it, polish with emery, and draw to a straw color. The wheel should revolve freely on its pin, the latter being a drive fit in the leg. Keep the wheel lightly oiled.—*Floyd McGuckin, Ridgewood, N. J.*



HANDLING TUBING



Work tubing as little as possible, for bending and twisting tend to harden it. To cut a piece from a coil, place the coil on a bench or on the floor, wheel fashion. Then hold the end with one hand and unroll the coil with the other. Never uncoil tubing by pulling it sideways, for this may twist it, throw it out of round, or harden it.

Even after you carefully unroll tubing, it may not be straight. To straighten, lay the tubing on a smooth floor or bench and use a board flatwise, pressing down the high spots. Don't press so hard that flat spots are formed. Soft tubing is very easily dented, and dents may cause the tubing to collapse while being bent.

You can also straighten long lengths by slapping them against the floor. Turn the tubing as the slapping operation continues. It is best to have a helper for this method. If you attempt it yourself, fasten down one end.

FOR YOUR POPULAR SCIENCE INFORMATION FILE

How to Grain Metal Surfaces With Paint

A little practice with a few simple tools will enable you to disguise anything paintable.

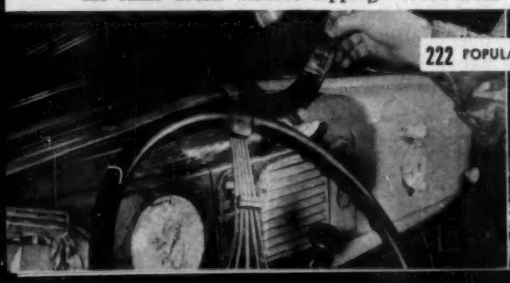
By Bernard Gladstone

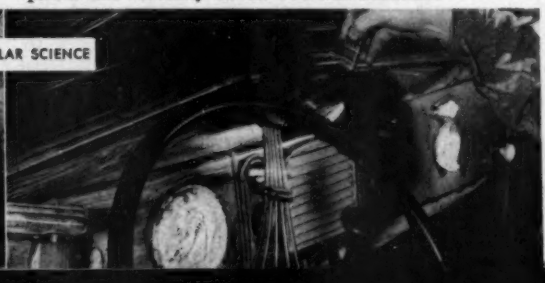
PS PHOTOS BY W. W. MORRIS

HERE'S an easy way to dress up an old piece of furniture or your car dashboard. The finished job isn't a detailed copy of any specfic wood, but it does give the color and grained appearance of a natural hardwood finish.

Graining consists of four steps:

Mask off instruments on dashboard before beginning to work. Apply ground coat and let it dry. Put on graining color (below) with as dry a brush as possible. Wipe excess color off brush on rim of the can. Spread color thin to avoid runs. Don't worry about brush marks. Streaks and brush marks are an advantage. Work the brush almost dry before redipping. After covering the work, let the color set for about 10 minutes. If you find that an excess amount of paint has sagged to bottom of work, go over it with the same brush without dipping. Work from the bottom up. This will redistribute the color evenly. One method of graining with a cut-down paint brush is shown in photo at right below. Hold the brush at almost right angles to the work. Press down hard, spreading the bristles while you draw the brush through the wet graining color. You can get more natural-looking color variations by twisting and weaving the brush as you pull it along to form the grain lines. On the window frames of your car, run the grain horizontally along the top and bottom pieces and vertically on the two side members.





1. Applying the ground coat.
2. Applying the graining color.
3. Working the grained effect into the graining color.
4. Applying coats of varnish.

Here are the tools you'll need:

- Good-quality brush to apply ground coat and graining color,
- Small, pocket-size whisk broom,
- Small, pointed pencil brush or liner,
- One-inch brush for graining, and
- Two-inch brush for graining.

Buy the cheapest 1″ and 2″ brushes. Use a sharp knife or razor blade to shorten the bristles until only ¾″ is left.

The photos on this spread and the following page show you all the steps in graining a cabinet and the interior of a car. The data card tells you how to mix ground coats and graining colors.

If you are not too fussy about exactly matching the wood color you want to imitate, you can buy ready-mixed ground coats and graining colors.

But if you do mix your own ground coat, use a good grade of enamel undercoater. Add pure tinting oil color to make the shade you want. Tinting oil colors come in small tubes in paste form. Squeeze an inch or so into a cup and dissolve it with a little turpentine. Add it to your undercoater a few drops at a time. Keep stirring as you add the color. Remember that you can always add more color, but you can never take out any excess color that you might put in. When two or more colors are involved, add a few drops of one and then a few drops of another. Mix the color to match the lightest portion of the natural wood you are trying to imitate.

Joints can be simulated with pencil brush or liner dipped in graining color. When graining is dry, apply two coats of spar varnish.

To mix the graining color you'll need flatting oil, turpentine, tinting oil colors, dry cornstarch, and Japan drier. Mix three parts flatting oil and one part turpentine. This will be the liquid base for your graining color, to which you add tinting oil colors. Use about a tablespoon of cornstarch to each pint of graining liquid. This will keep it from running. Add about a teaspoonful of Japan drier and stir thoroughly. Stir the graining color while working because the color tends to settle out.

As an approximate guide, you can add a little more than 1 fluid oz. of paste color to a pint of the liquid base.

Try both the ground coat and graining color on scrap before applying them.

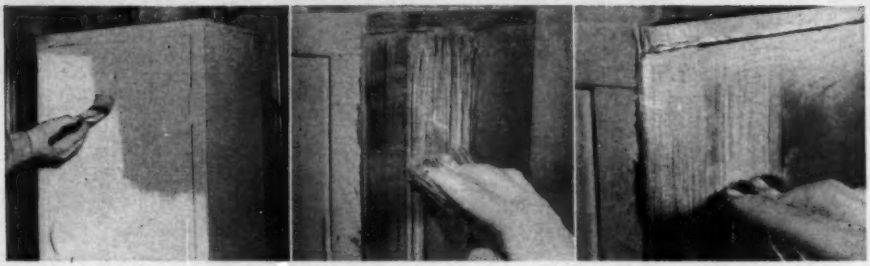
For directions on how to wood-grain a metal cabinet, see the next page.

GRAINING COLORS

TYPE OF WOOD	TO MIX GROUND COLOR	TO MIX GRAINING COLOR
Natural Oak	Make a light buff color by tinting undercoater with raw sienna. Add just a drop of Venetian red.	Liq. Base: 12 oz. flatting oil, 4 oz. turps., 1 tbsp. cornstarch, 1 tsp. Japan drier. Tint with raw sienna.
Maple	Same as above only much lighter. Resultant color should be just off white.	Tint base with raw sienna plus a touch of burnt umber.
Chestnut	Same tints as oak but darker. Resultant color should be regular buff shade.	Tint base same as maple.
Walnut, Dark Oak	Make a biege color by tinting with burnt umber and just a touch of Venetian red.	Tint base with Vandyke brown.
Mahogany	Tint with burnt umber and about half as much Venetian red.	Tint base with burnt umber and almost as much burnt sienna.

FOR YOUR POPULAR SCIENCE INFORMATION FILE

How to Give a Wood-Grain Effect to a Metal Cabinet



Brush on the ground coat carefully, left above. Work with a fully loaded brush and avoid laps, streaks, and brush marks. In most cases, one coat will do. But if the first coat doesn't cover evenly, apply a second coat after the first one has dried. Let the ground coat dry about 24 hours. When graining with the whisk broom, grasp it firmly with your fingers near the ends of the bristles, center above. Start at the top and draw the whisk broom down through the wet graining color. Vary the pressure of your finger tips to obtain different effects. Twist your wrist at times and weave it back and forth to get a more natural grain appearance. Graining with the dry, cut-down brush (right above) gives less contrast than the broom.

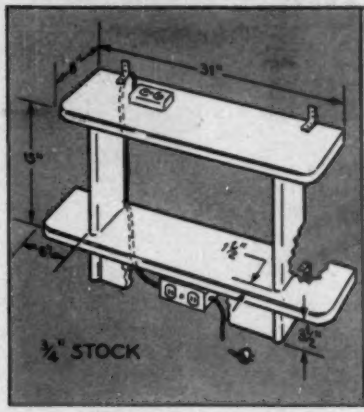
Use the 1" brush to run a narrow grain across the top of the cabinet. This represents the edge of the cabinet's top board. Then dip the pencil brush in the bottom of your graining-color can and draw a straight line where the joint would be. Whether graining with the whisk broom or brush, keep a rag handy. Wipe the brush clean after every few strokes. Otherwise, the color will start to smear on the work.

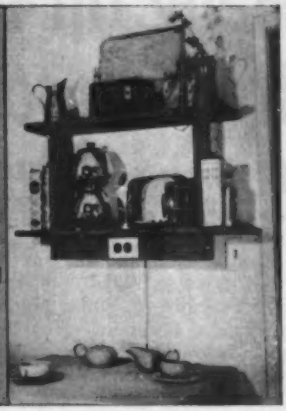
Pickled finish is easy to apply to a newly grained surface. But first let the graining color dry thoroughly. This finish tones down the grained work and conceals any irregularities in the graining. Use a ready-mixed, linseed-oil-base white house paint. Mix it six parts of house paint to one part turpentine. If you want a grayish tone, add a few drops of burnt umber. If you want a creamy tone, add a little raw sienna. Then brush the paint evenly over the surface, as shown in the photo at left.

After you have covered the surface with paint, use a wad of waste to wipe off most of the paint. But don't wipe it all off. Do your wiping parallel with the grain. This will leave the white, streaky, overcast appearance that is called a pickled finish. If the waste leaves lint on the surface, let the paint dry and you can brush off the lint. After the paint has dried 24 hours, finish it with a coat of spar varnish and a coat of flat or semi-gloss varnish. Sand lightly between the two coats of varnish.

Finished graining job (above) changed appearance of cabinet from metal to wood. Interior of cabinet was repainted in a solid color.

It's a Cinch to Make Coffee and Toast with This Setup





WE'VE given our kitchen appliances a place of their own on a shelf wired for convenience. The gadgets are ready for instant use and we no longer have to do bending exercises with the line cord when we want coffee or toast.

The shelf consists of seven pieces of wood and two double electrical outlets. I put a surface outlet on the top shelf—for a radio or clock—and a flush outlet in the bottom-shelf apron. Since the underside of the shelf is open, I enclosed the lower receptacles in a standard outlet box.

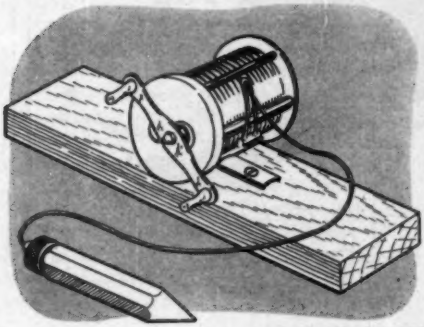
Because kitchen appliances draw a lot of current, I used heavy-duty wire to connect the two outlets to a socket near the floor. I attached the shelf to the wall with four metal angles, screwing these into wall studs first and fastening the shelf to them later. The angles aren't centered on the shelf, but since they are concealed this makes no difference.—*Robert Hoppough, Encino, Calif.*

Old Newspaper Cuts Calking Costs

AROUND the doors and windows of my house were some deep cracks that needed calking. I saved calking compound by stuffing the cracks almost full of dampened newspaper and then applying the compound. The old newspaper took up a lot of room that otherwise would have taken compound.—*Mrs. George C. Adams, Hutchins, Texas.*

Reel Keeps Plumb Line From Kinking

WOUND on an inexpensive fishing reel like the one below, a plumb line will never get tangled. Mount the reel on a short block of wood.—*F. Shelford, Los Angeles.*



Filed Pinch Clip Makes Paint Scraper

A SCRAPER for removing dried paint from wood, glass, linoleum, or floor tile can be made from a large spring-type paper clip. File the blades sharp and cover the handles with a bicycle handlebar grip. When using the tool on some surfaces you may get best results by keeping the scraping edges separated. This can be done by inserting a small block of wood between the jaws of the clip.—*John J. Rea, Urbana, Ill.*

Cork on Bottom Protects Tackle Box

A THICK sheet of insulating cork glued to the bottom protects my tackle box when I put it down in wet places along a stream. It also keeps the box from rattling around on the floor of the car. Suitable cork can be bought at a refrigerator repair shop.—*John Krill, North Lima, Ohio.*

Hang Up Your Ironing Board

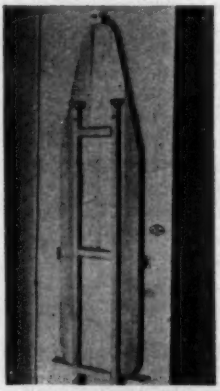
HERE'S a practical substitute for a built-in ironing board—a folding board mounted out of the way and out of sight inside a pantry or closet door.

You can take the top from an old collapsible board or make one out of ¾" white pine. Assemble the lower support frame with corrugated fasteners, using the dimensions given below, and attach 3" T hinges to each end with 1" flathead stove bolts.

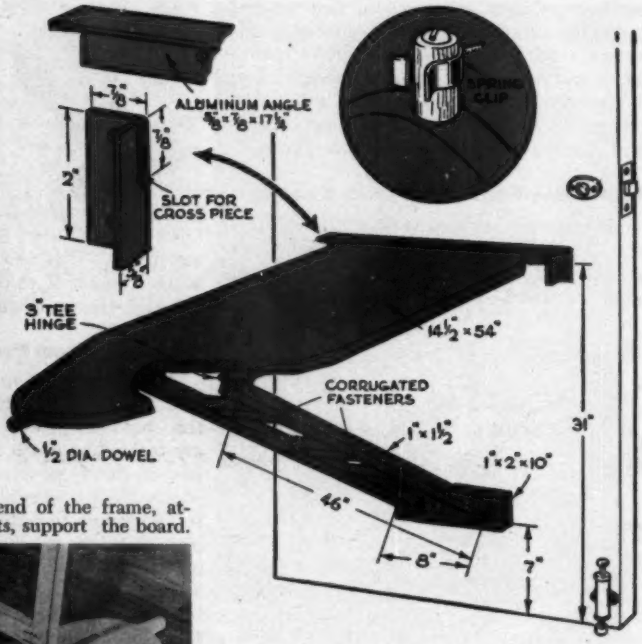
Screw two hinges to the underside of the ironing board in the position shown, and fasten the others to a block screwed to the door. The block is needed to give the board clearance when it is folded up.

Screw a 17¼" length of ⅝" by ⅝" aluminum angle on the butt end of the board, with the ⅝" face on top. Projecting beyond the board on each side, this angle will slip into slots in brackets on the door. These brackets, made of 2" lengths of the same angle, keep the board secure while it is being used. When the angle is pushed up out of the bracket slots, the board folds flat against the door.

A stop on the bottom of the door will keep it from swinging.—*John Rogers, Dallas, Texas.*



A dowel on end of ironing board slips into a spring clip on the door when you fold board up.



Two T hinges at each end of the frame, attached by screws and bolts, support the board.

Termites won this battle. The wooden girder at top is the result of a long campaign by termites. It is completely eaten away inside and is no longer capable of supporting weight.

Termites Can Be Defeated

They are a deadly enemy in most parts of the U. S. To lick these foes, you first scout them out, and then you counterattack.

By Gardner Soule

THERE are probably termites where you live. The only two states that do not report damage from termites are North and South Dakota. Termites are abundant along all coasts, in the Ohio River Valley, and in the southern part of the Missouri and Mississippi River valleys.

They are *not* spreading from area to area. They seem more common today and appear to be spreading because they occur in so many places where new homes are built.

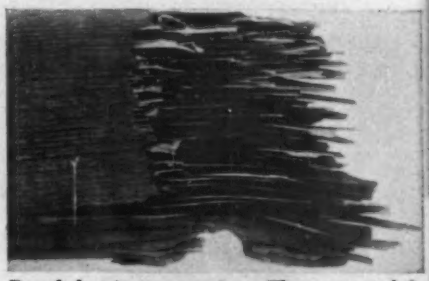
They do not work fast. It takes several years for a colony to seriously damage a building. They can be licked by annual inspections and by understanding them and fighting them intelligently.

If termites invade your home, you must act, or risk damage. A mistake made by some people is to do nothing about termites. These people believe that the knowledge that termites are there will lower the value of their property. But termites are almost everywhere in the U. S.

If nothing is done about a termite infestation, the colonies will grow and grow and probably attack nearby homes. The knowledge that a homeowner is making every effort to control termites should increase the value of his property.

The important questions are: Do I have termites in my house? How do I tell? If they have invaded my house, what do I do?

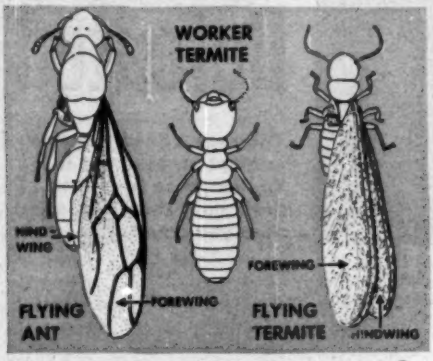
To get the answers, PS consulted authorities in federal and state governments; in exterminating companies; in lumber yards and building concerns. Here are the answers. The first one is: *scout the enemy.* Understand him. Learn to recognize the signs he leaves. If you know him, you can lick him. To begin scouting, turn the page.



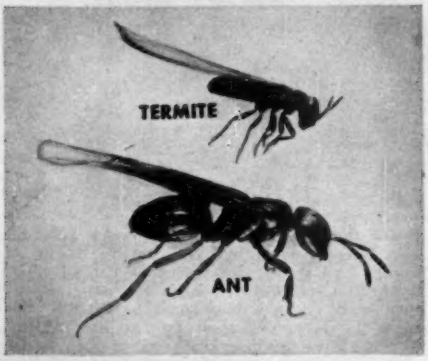
Proof that it was termites. They eat out definite tunnels separated by thin partitions of sound, firm wood. Because they cannot stand light, they chew away inside of lumber and their work rarely is seen from the outside. Because they eat wood, they leave no sawdust, but they do leave tiny specks of excreta that do not show up in the photograph above.

Scouting for termites.

The subterranean termite is the one that damages homes. At right is the termite as you are most likely to see him. This one is a winged, reproductive termite. Male (king) and female (queen) look alike. They have four silvery wings. Each spring, or at other warm times, reproductive termites (they can stand light for short periods) fly out into the open air, pair up, and start new colonies. The termite's body is an oblong—about ¾" long—and of even thickness from stem to stern. Termites are often confused with flying ants.



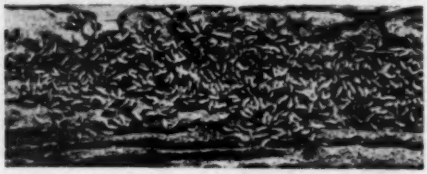
Insect most often mistaken for termite is flying ant. The termite is ¾" long. The ant may be ¾" long—or shorter. Termite's wings are opaque. Ant's are transparent. Veins in termite's wings are same color as wings. Veins in ant's wings are dark. Termite has four wings of about the same length. Ant has two short wings and two long wings. Termite has straight, oblong, unsegmented body—same thickness all the way. Ant has hourglass, wasplike, segmented body—abdomen is separated from rest of body by thin stem. The shape of the body is probably the easiest way to identify termites. To be certain of identification, ask a reliable pest-control firm. Or you can send a suspected insect to your state entomologist for confirmation. Ship the insect in a securely packed bottle of radiator or rubbing alcohol.



Subterranean termites dig in colonies in the ground. They must have the moisture they find there. To get food (wood) they build tunnels up foundation walls or across almost any obstacle. There are three kinds of termites: reproductives who breed, soldiers who fight natural enemies, and workers who build tunnels and keep the others supplied with food. Young, workers, and soldiers are gray or cream colored. They are blind, soft-bodied, and can't stand open air.

A sight like this in your home is a sure sign that you have termites. Male and female reproductives will fly forth in your home and try to get outdoors. Discarded wings (left) litter the floor beneath a door or window where they have tried to find their way outside.

Except at swarming time, termites are never visible unless their galleries are broken open. In the photo below, the surface of wood has been removed to show the termites at work. Most of those shown here are worker termites.

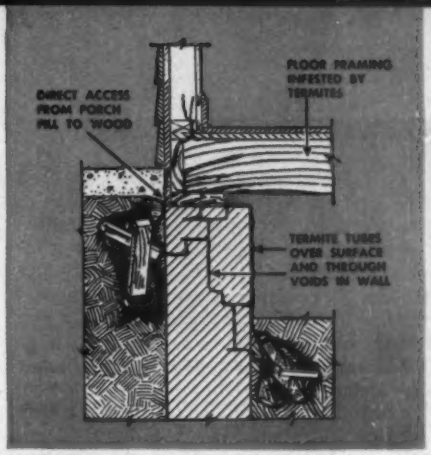


How termites get into a house.

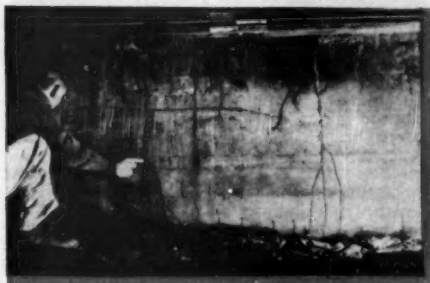
THE termite can infiltrate without disclosing his supply lines. He can sneak in through cracks in masonry walls. He can sneak in wherever he can find untreated lumber in contact with the ground. He can come in through a wooden basement window frame, or a fence or trellis near the house, or shrubbery, or on pipes through a basement wall.

The supply line of the termite—the shelter tube—is a miracle of nature. These enclosed passages lead the termites from the moisture in the soil to the wood of your house without exposing them to the drying effect of open air. Tubes are earthlike, flattened tunnels ¼" to ⅜" or more in width. They are built of fragments of earth and partly digested wood. Tubes may be built along pipes or up almost any type support that is placed beneath a house.

The drawing of the porch (right) shows how termites can infiltrate a home unseen.



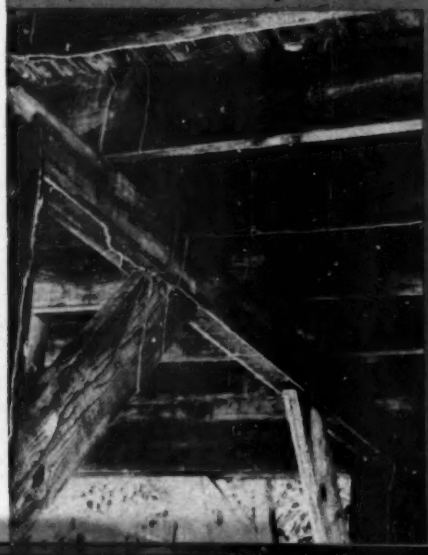
From ground and from wood debris in the porch fill, termites can get into floor framing without being seen. Through cracks or voids in foundation, termites can travel up to floor framing. Wood scraps in soil enable them to live while they put out new supply lines. In one state—New Jersey—three-fourths of termite damage was from porch fills as above, or from identical conditions in terraces that adjoined houses. [*Continued on next page*]



Shelter tubes cross concrete foundations.

They can be built downward from girders.

They cross treated to unpoisoned wood.



They build from spreader sticks to girders.

How to counterattack.

You should scout for termites at least once a year. Inspections should include:

- Watching for swarms or old wings.
- Striking suspected timber with a hammer. A dull thud indicates termites or other trouble. A clear ring means no trouble.
- Opening suspected timber to see if you find termites at work.
- Checking on all places where timber approaches the soil.
- Searching carefully for shelter tubes.
- Checking identification of bugs.

If you find termites, study the situation carefully, or hire a reliable exterminator. Some things are no good in your counterattack—fumigations, spray applications, or poisonous baits, for example.

Your information about your enemy has shown you that termites require two things —moisture and food. Keep them away from either and you defeat them. Simply scraping away shelter tubes may cause termites to die for lack of moisture or food—whichever they cannot reach.

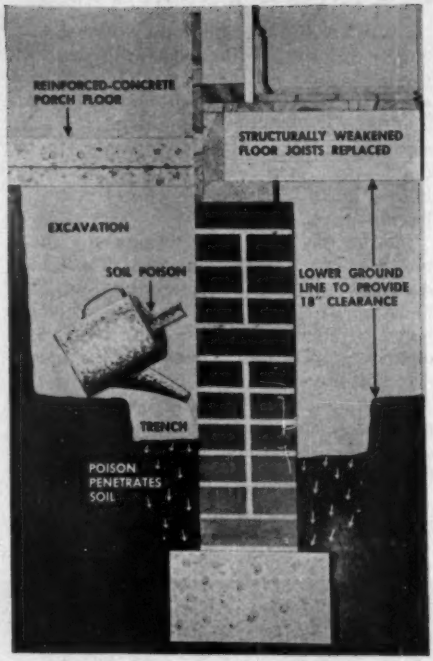
Eliminate moisture in the ground. It might come from an icebox drain or a dripping outside faucet. If you have no basement, be sure your foundation is ventilated so moisture will dry up. Also eliminate food for termites. Get rid of scrap lumber or dead wood in the ground.

If termites enter in any of these ways:

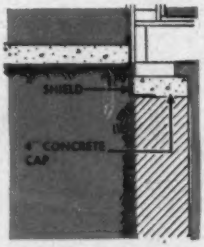
- Through cracks in masonry? Seal them or put barriers between masonry and wood.
- Timber in contact with soil? Eliminate such contacts with structural changes.
- Through a basement window frame? Replace wooden frame with metal one.
- Through fence or trellis? Keep it at least 2" from the house.
- Through shrubbery? Keep it 12" away.
- On pipes through foundation walls? Pack them in coal-tar pitch or plastic cement at the entrance points.

Soil poisons attack termites in their base in the ground. Applying such poisons is usually a job for trained exterminators. One poison recommended by the U. S. Department of Agriculture is five percent DDT in No. 2 fuel oil. This is applied one quart per cubic foot of soil.

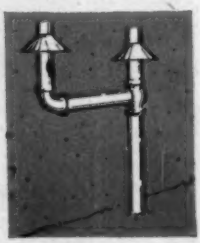
The pictures on this and the opposite page show poisoning and barriers that stop termites in old and new homes. They show that termites can be defeated, and they show how it is being done.



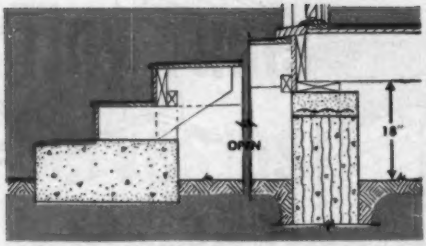
To get rid of a termite infestation in a porch fill, the fill is first removed and soil poison poured on both sides of the foundation. A clearance of 18" from joists to ground permits inspection under the house and helps ventilation that reduces moisture. Weakened timbers are replaced with new wood, or with wood that has been treated to resist termites.



Another method of remedying or preventing termites from crawling out of a porch fill and into your home is shown in the drawing at left. Metal shield is inserted between porch slab and woodwork. Shield extends down to and turns under a 4" reinforced concrete cap.



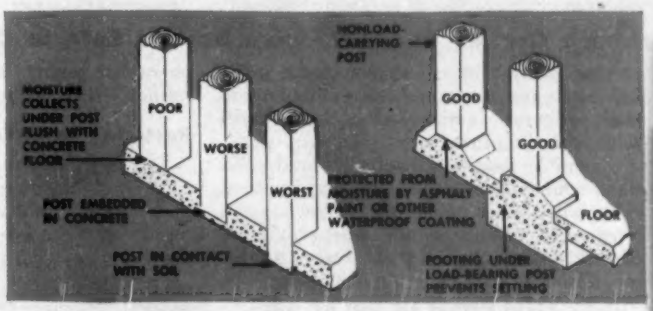
Pipes extending into the ground can be protected by metal shields soldered to the pipes at least 12" and preferably 18" above the ground. Outer edges of shields should project at least 3" from the pipes to obstruct the possible building of termite shelter tubes.



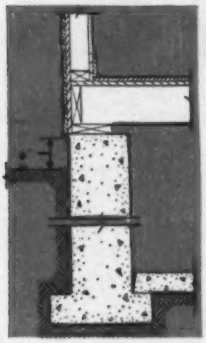
Wooden porch steps may be protected from hidden infestation of termites by resting the steps on a poured concrete base that forms the bottom step. Concrete base or step should project at least 6" above ground. The porch supports should rest on similar concrete bases.

Spot exterminating job. If termites are suspected in only one or two places, soil poison may be used in high strength. If termites are under concrete, hole may be drilled so that poison can be injected through it. In the photo above, such a hole is shown being drilled.

Basement post must be kept away from ground. Wood posts on concrete floors, when placed like those on left in drawing, are subject to termites. Correct methods are shown at right.

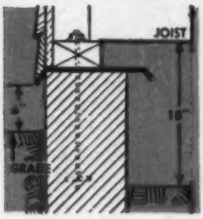


Here are ways to make new homes termite-proof.

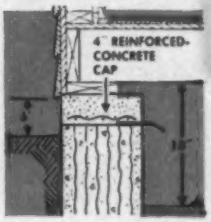


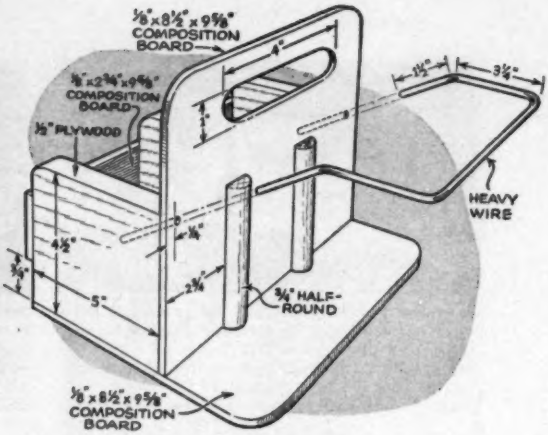
Poured-concrete foundation walls or piers—like the one pictured at left—are easy to inspect. Termites cannot go up through them, and regular inspections will reveal any shelter tubes built upon them. All expansion joints should be filled with coal-tar pitch.

Reinforced poured-concrete cap (shown in the drawing at right) on masonry walls or piers prevents sneak attack by termites. If termites come up through cracks in foundation walls or piers, they cannot get through the cap. Cap should be at least 4" thick and must be poured in one continuous operation to avoid joints. Minimum clearance of 18" under the building and 6" outside will allow room for inspection for the presence of shelter tubes or for possible cracking of the cap.



There are several kinds of shields that you can use. The drawing at right shows a strip shield atop a masonry foundation wall. The drawing at left shows a bread-pan shield over an uncapped foundation wall. A shield should project at least 2" beyond the face of the wall and then have an additional 2" turned down at a 45° angle. Shields must be 12" above the ground. Eighteen inches is better. A noncorrosive metal must be used for shields, and shields must not be painted on their undersides.





Lunch Carrier Keeps Vacuum Bottles Safe in Car

THIS easily built carrier solves the problem of finding a safe and convenient way to carry vacuum bottles and a light lunch while traveling in a car.

Assemble the pieces with 1" brads and glue, countersinking the brads and covering with wood filler. Bore the holes for the wire small enough so the wire will be a firm fit. Wrap the wire with tape, or slip on rubber tubing, to keep the bottles from rattling.—*R. L. Hoppough, Encino, Calif.*

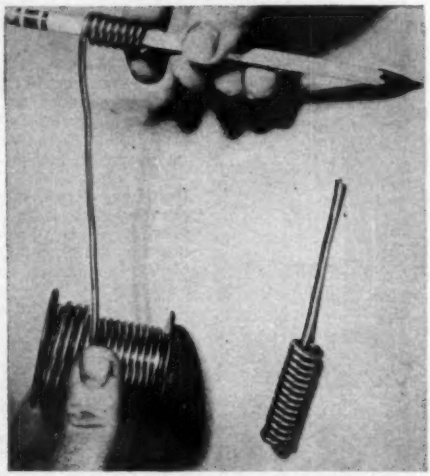
Restoring Table-Tennis Balls

DENTED but unbroken table-tennis balls can often be brought back to shape if placed in a washbasin with the hot water turned on. The hot water heats the air in the ball, causing it to expand.

Tubing Form Pivots Up Out of Way

A PIECE of 4" pipe about three feet long mounted as shown can be used to form tubing from sheet metal. The hinge lets you swing it up out of the way when not in use. A block under the pipe adds rigidity. —*Ralph S. Wilkes, Keuka Park, N.Y.*

Solder "Pencil" Is Easy to Use

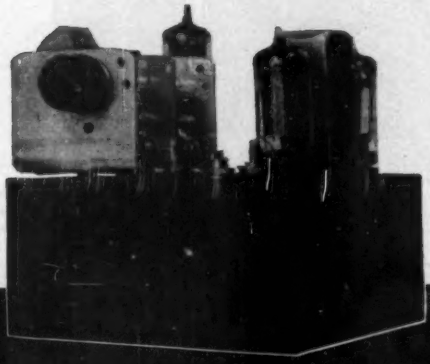


WIRE solder can be put into a convenient form by wrapping turns around a pencil. Then slip the coil off the pencil and pull one end through the coil. In use, the solder is pulled through the coil as needed.—*David Findlay, Brooklyn, N.Y.*

Tiny Tuner Serves as Bedside Radio

It isn't tough to build, and has only three tubes. But hitched to an amplifier it gives quality superhet performance.

By Noel Namtro

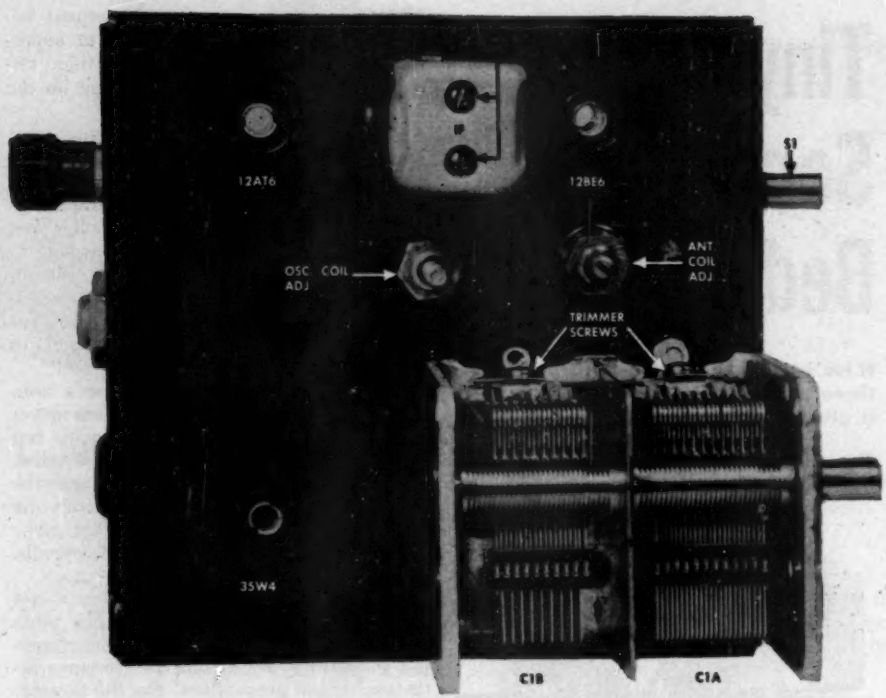


THE miniature radio tuner pictured below really puts the "super" in superheterodyne. Its two-tube-plus-rectifier circuit picks up practically everything on the air and separates stations cleanly.

- Place it in a convenient niche near your bed and you'll never be bothered by someone yelling "turn that thing off."
- Connect it to any good phonograph amplifier—such as the midget unit that last month's POPULAR SCIENCE told you how to build—and you will have a radio-phonograph combination. This tuner and the amplifier described last month are ideal for compact, *vertical* cabineting. They pair up nicely in an ordinary bookcase.

Small parts account for the tuner's compactness. Some of its components are newer types that not only take up less space but actually work better than older counterparts. The antenna and oscillator coils and the intermediate-frequency transformer are wound on powdered-iron cores that make them especially sensitive to weak signals. The set has an excellent tone.

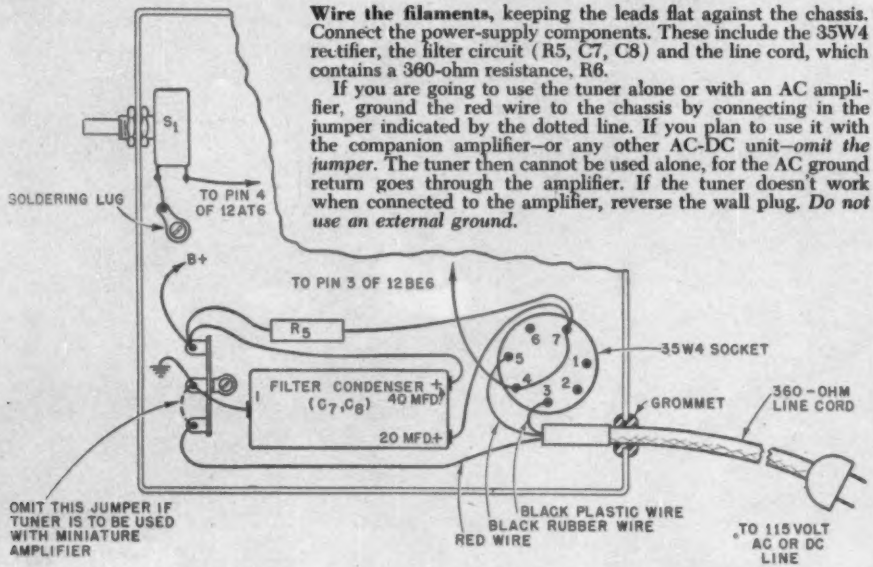
Illustrated directions for building it are given on the next three pages. The parts should not cost more than $10. The chassis is a standard 4" by 4" unit and requires little mechanical preparation. Put the filament wiring in first, then connect the power supply, and carefully check over the whole unit before you test and tune it.



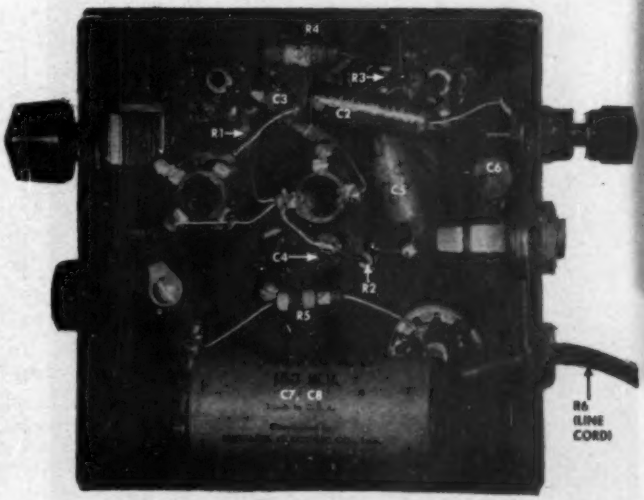
Lay out the large parts this way. Top view of chassis, above, and corresponding bottom view on facing page show all fixed parts mounted. Each of these tube sockets clips into a single ¾" hole. Other types of sockets may need extra holes. Note holes directly below contact lugs

Wire the filaments, keeping the leads flat against the chassis. Connect the power-supply components. These include the 35W4 rectifier, the filter circuit (R5, C7, C8) and the line cord, which contains a 360-ohm resistance, R6.

If you are going to use the tuner alone or with an AC amplifier, ground the red wire to the chassis by connecting in the jumper indicated by the dotted line. If you plan to use it with the companion amplifier—or any other AC-DC unit—*omit the jumper.* The tuner then cannot be used alone, for the AC ground return goes through the amplifier. If the tuner doesn't work when connected to the amplifier, reverse the wall plug. *Do not use an external ground.*



on tuning condenser. They allow connections to be brought up from under chassis. Antenna and oscillator coils (L1 and L2) are mounted vertically to make the adjustment screws accessible from top of chassis. Do all drilling before you install the parts.



Complete the wiring and add the small parts. Instruction sheets for wiring the oscillator and antenna coils and IF transformer usually come packed with them. Usual color coding for IF transformers is: blue for plate (pin 5 of 12BE6), and red for B plus (connect this to R5 or to pin 6 of the 12BE6). Green goes to the diode plates (pins 5 and 6) of the 12AT6; and black to the junction of R2 and C4.

[Turn the page.]

To use it with an amplifier, make a cord like the one at the left from shielded wire and a standard PL-55 phone plug. Connect the center conductor to the inner lug and the shield to the frame contact. At the other end solder lugs or a plug suited to the input terminals of the unit you plan to use. The plug fits the output jack on the tuner, and the lugs shown connect with the input terminals of the companion amplifier. Make sure the shielded wire is insulated its full length, because the braid becomes part of the chassis ground and is electrically "hot."

To align the tuner: 1. Connect it to amplifier or plug in headphones. Attach an antenna.

2. Close the two trimmers on the tuning condenser by turning the screws clockwise.

3. Set tuning condenser so plates are approximately half in mesh.

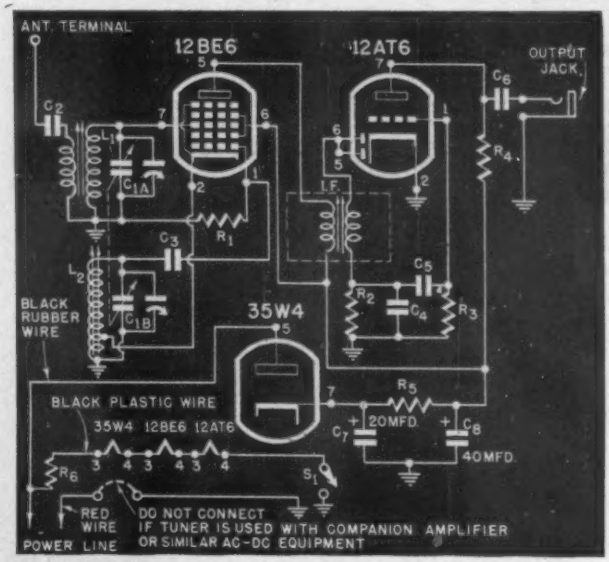
4. Using an *insulated-handle* screwdriver, turn the oscillator-coil adjustment screw till you bring in a station. If you run through more than one station, stop at the one closest to 880 kc.

4. Tune in your local station nearest 570 kc. (the condenser plates will be almost fully meshed), and adjust the antenna coil for maximum volume.

5. Adjust IF-transformer slugs for greatest volume on same station. Use light screwdriver pressure because the screw heads are fragile.

6. Tune in a station at high end of dial. If condenser is fully unmeshed before you reach it, adjust oscillator trimmer (the screw on C1B) till the station comes back into tuning range. Readjust antenna coil for best volume.

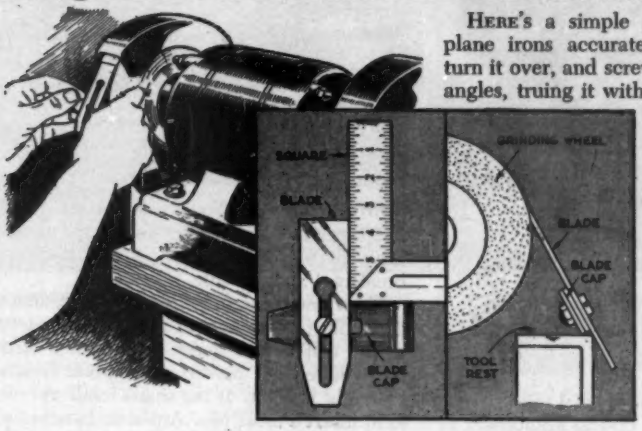
7. Go back to 570-kc. station and, if necessary, touch up antenna-coil and IF adjustments for best compromise between high and low stations.



Parts List (and approximate cost)

R1: 22,000-ohm, ½-watt (.10).
R2: 470,000-ohm, ½-watt (.10).
R3: 10 meg., ½-watt (.10).
R4: 150,000-ohm, ½-watt (.10).
R5: 40,000-ohm, ½-watt (.10).
R6: 360-ohm line-cord (.75).
C1A, C1B: Midget 2-gang superhet tuning condenser (cut-plate osc. section) with built-in trimmers (1.30).
C2: .0005-mfd., 600-volt paper (.25).
C3: 50-mmf. mica (.20).
C4: .00025-mfd., 400-volt paper (.25).
C5: .005-mfd., 200-volt paper (.25).
C6: .01-mfd., 200-volt paper (.30).
C7, C8: 40-20-mfd., 150-volt dual electrolytic (.90).
L1: Ant. coil for broadcast band; adjustable iron core (.65).
L2: Tapped osc. coil for 465-kc. IF. Adjustable iron core (.65).
IF: Intermediate-frequency transformer, 465-kc., iron-core midget type (1.00).
S1: SPST rotary switch.
J: Midget open-circuit jack and matching PL-55 plug (.80).
Antenna binding post (.20), 3 7-pin miniature tube sockets (.18 ea.), 2" by 4" by 4" chassis (.50), tubes (2.50), 3-terminal tie strip (.10), misc. hardware.

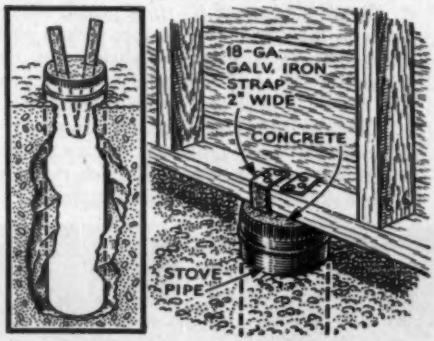
Sliding Plane Iron Back and Forth Grinds a Hollow Edge



HERE's a simple method of sharpening plane irons accurately. Remove the cap, turn it over, and screw it to the iron at right angles, truing it with a square before tightening the screw. Rest the cap on the grinder tool rest and adjust the rest so the iron hits the wheel at the desired angle. Start the grinder and slide the assembly back and forth along the rest. This will give a perfect hollow-ground edge.—*Charles Jeglinski, New Bedford, Mass.*

Concrete Posts Cast in Stovepipe

DISCARDED pieces of stovepipe can be used as ready-made forms for concrete posts on which to set a garage or other small building as shown below. Sink the pipe into the ground to the desired depth and fill with concrete. Embed in the mortar a U-shaped strip of galvanized iron. After the mix sets, nail the ends of the strip to the foundation plate. If the earth around the pipe is left loose temporarily, the post can be moved slightly to compensate for small errors.— *W. B. Smith, Jr., Toronto, Can.*



Water for Your Steam Iron

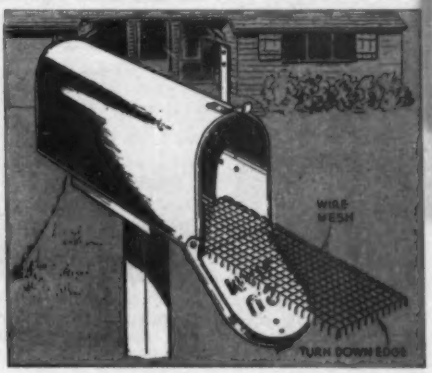
MANUFACTURERS of steam irons recommend that you use distilled water to prevent damage to the iron. We use the water we get when we defrost our refrigerator. Being condensed water vapor, it won't harm the iron.—*Leonard L. Allen, Woodside, N.Y.*

Footwork Helps Measure Vertical Line

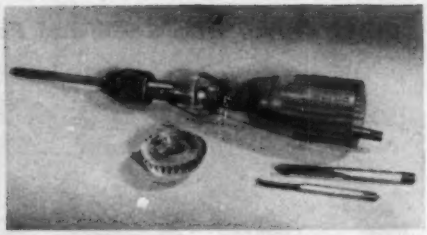
EVER try holding a tape line over a considerable vertical distance without a helper? Here's a way you can do it alone. Stick a carpenter's pencil through the tape ring, step on the pencil, and you'll be able to measure above your head without trouble.

False Bottom in Box Keeps Mail Dry

MANY rural mailboxes have a corrugated metal bottom, and water is apt to settle in the grooves during a driving rain. After more than once finding the mail soaked, I made a raised platform of hardware cloth to fit the floor of the box, as below. Now my mail stays dry.—*A. Zanelli, Wyckoff, N. J.*

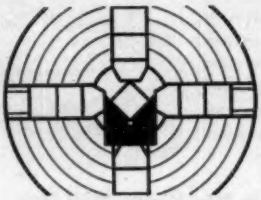


Use for Broken Taps. Special screwdrivers for the tiny screws on optical equipment or models need not cost you anything. Grind them from broken taps. Then mount them in a tap wrench or, better still, in the spin tap wrench shown at right.



Spin Threads In. You'll find this the handiest tap wrench you ever used. Its natural grip gives good control, minimizing tap breakage, and it works fast.

Turn down the upper end of an ordinary T-handle tap wrench to the same diameter as the rest of the shank. Bore out a large file handle or a plastic screwdriver handle to a tight push fit. If the shank tends to twist in it, insert a cross pin. A plastic handle can be bored out as shown in the photo to hold several taps. Shoulder down the severed end to a snap fit in the bore.—*Floyd McGuckin, Ridgewood, N. J.*



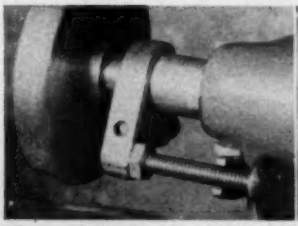
One-Jaw Chuck. Each piece of square stock usually has to be centered individually in a four-jaw chuck. When you have a lot of identical pieces this V-block fixture is well worth making. Held by three of the chuck jaws, it is quickly adjustable to various sizes of work, and will handle round stock as well as square. Since only the fourth jaw is loosened and tightened to change work, it's fast to use.—*H. W. Spross, Poughkeepsie, N. Y.*

Tailstock Depth Stop. It's often a real advantage to have a positive stop on the tailstock ram for drilling, shouldering with an end mill, and similar jobs. You can add such a stop to your lathe as shown below.

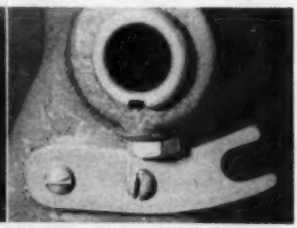
The stop consists of a split collar that can be clamped over the end of the ram, an adjustable screw threaded into the collar, and a forked bracket on the housing.

Chuck a piece of ¾" or ⅞" steel, aluminum, or brass and bore it out to a close push fit for the ram. File it to shape, saw the clamping slot, and drill and tap holes for the clamping bolt and depth screw.

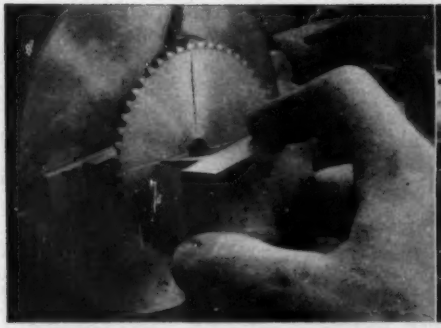
Saw and file the forked stop from steel at least ⅛" thick. Drill and tap two holes in the tailstock casting, and attach the stop with bolts.—*John M. Avery, Dexter, N. Y.*

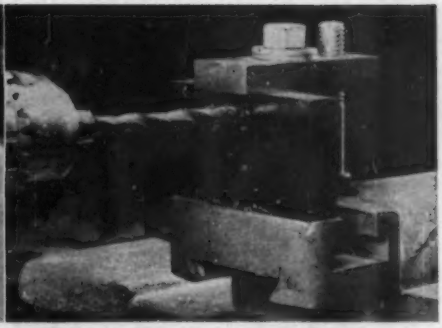


Mounted on the near side of the collar that is clamped to the ram, the depth screw is readily adjustable. Use a lock nut that one of your regular lathe wrenches will fit.

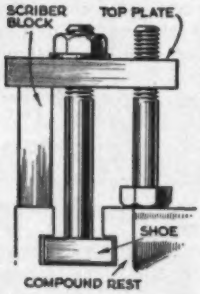


Hole for clamping bolt is drilled clearance size one side of the slot, tapped in other side. On some lathes, hole could be made in tailstock for depth screw, eliminating forked bracket.





Center-Height Scriber. With this scriber you can mark a true diameter on work chucked in the lathe without measuring or adjustment. Made to slide on or be clamped to the top face of the compound rest, it's handy for indexing and other layout operations.



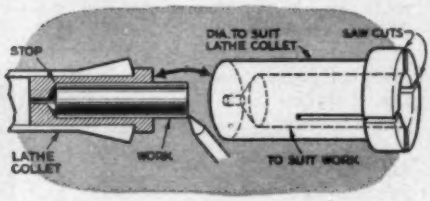
Turn the scriber by machining a long point on a piece of ¼" drill rod. Finish with a few strokes of a fine file and oil. Unless your chuck runs dead true, better chuck the rod in a collet, or drive it into a hole drilled in a piece of scrap stock you've chucked. Hardening is desirable.

Clamp the block, a piece of ½" cold-rolled steel, on the compound at exactly 90° to the lathe ways. This can be done with a shoe, a top plate, and two long bolts as in the drawing. Run through a small and intermediate-sized drill, and then a D drill (.246"), using plenty of cutting fluid. Then chuck a ¼" reamer and enter this carefully just far enough to leave the hole a nice press fit for the scriber. Chuck the scriber in place of the reamer and press the block onto it with the carriage hand feed.

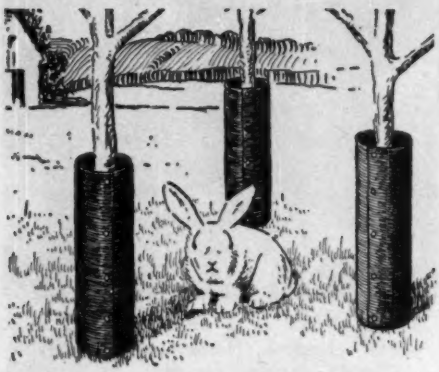
When using the scriber clamped on the rest, take care not to damage the point by crowding it against the work.—*Joseph Tracy, Manhattan, N. Y.*

Length-Facing Collet. Pieces faced to length in an auxiliary collet like this have been checked to a tolerance of .001". It consists of a piece of steel turned to fit into a regular lathe collet, with a shoulder to act as a stop. Inserted in the lathe collet, it is drilled right through with a small drill, and then counterbored with a second drill to the size of the work. Four slots are then milled or hacksawed to half its length.

The faced ends of the pieces are inserted and the opposite ends faced to length, the lathe carriage being run up to a stop located on the lathe ways each time.—*A. R. Morgan, Naugatuck, Conn.*



Blade of All Work. This gadget fills several workbench needs so well you'll wonder how you did without it. It's made from a good-quality screwdriver with a 3/16" or ¼" square-shank blade. Grind the four sides to a taper about 1½" long, with a sharp point. This gives you a good four-edged reamer for enlarging small holes, a handy scriber, and an excellent starter for small wood screws. Forming tapering holes in wood, it gives screws great holding power. —*J. McGuckin, Ridgewood, N. J.*



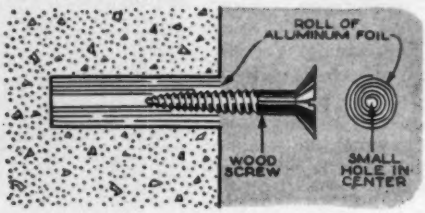
Solder Is Corrosion Resistant

MELTING at a few degrees more than 50-50 solder, a new all-purpose solder flows freely under torch or iron and is said to resist corrosion under severe conditions.

Farco All Metal Solder, made by Farrelloy Co., Phila., joins stainless steel and Monel as well as more common metals. With a flux offered by the manufacturer, it works even on aluminum. Bond is claimed to be twice as strong as with ordinary solder.

Aluminum Foil Makes Screw Anchor

I HAVE found that aluminum foil is a better anchor for screws in masonry walls than the usual wooden or lead plug. Roll up the foil (the kind sold for kitchen use) to fit the hole in the stone or concrete. Make a small hole down the center of the roll with a drill or ice pick. This gives the screw a starting hole. As the screw is twisted into the roll of foil, the outside of the roll tightens securely in the wall. —*Hugh Lineback, Stillwater, Okla.*



Roofing Paper Foils Rabbits

IF YOU are planning to set out young fruit or shade trees this spring, here's a tip. Wrap the trunk of each one with a sheet of tar roofing paper to keep rabbits from gnawing the bark.

Clip the edges of the paper together with a stapling machine, or if that isn't available just pin them together. Whitewash, burlap, and other conventional methods failed for me, but the roofing paper has worked well. —*Albert Zanelli, Wyckoff, N. J.*

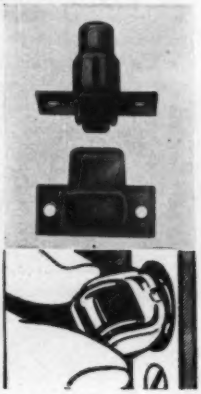
Casting Plastic for Home Plating

HOME craftsmen can now cast plastic and immediately electroplate it without further preparation. Electro-Plastic, a casting material offered by the Plasticast Co., of Palo Alto, Calif., freely conducts electricity. Mixed with a catalyst and poured into a mold, it hardens without heating in about 20 minutes. On removal from the mold it is only necessary to connect a wire and immerse the casting in a plating bath. Final steps are buffing to brightness and lacquering to protect the plating.

Mixed with catalyst, plastic is poured into a mold (left). Hardened casting is suspended head down in a plating bath by screw embedded in it (right). Hand holds plated, polished piece.

Roller Catch Is Adjustable

THIS door catch can be adjusted after it has been installed. You just pull the roller from its housing—as shown in the sketch at bottom right—and rotate it, varying the distance from the roller to the strike plate. Each half turn changes the distance 1/64", and the maximum adjustment is ⅜". It's made by Stanley, New Britain, Conn.



Trailer Makes Garden Tractor More Useful

You can build this cart with hand tools and store it almost anywhere.

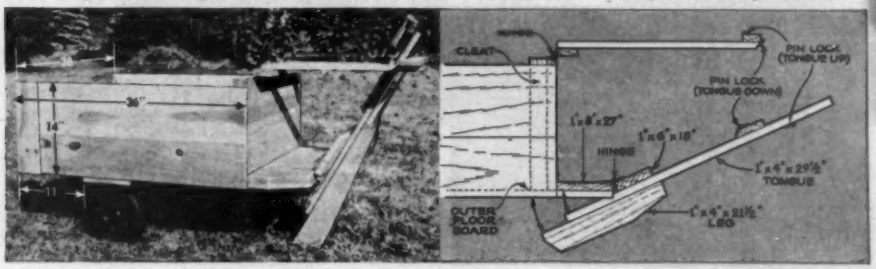
By John M. Avery

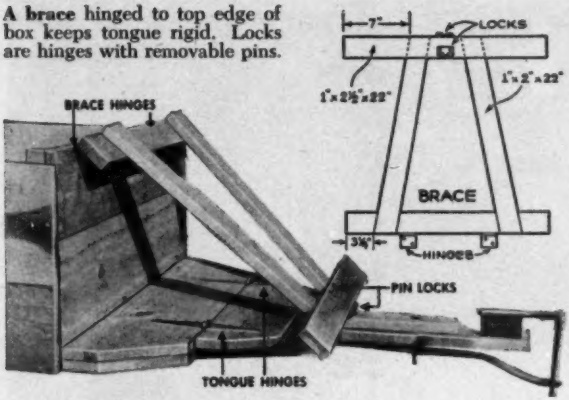
HITCH a trailer like this to a two-wheel garden tractor—and it can be used in many more ways on a small farm or surburban place. The kids will love it, too.

When the tongue is raised and locked, the trailer becomes a pushcart that you can roll around with ease. The folding tongue also makes it easier to store the trailer in a minimum of space.

Materials you need. Power tools would be helpful, but the cart can be built with hand tools. For the size shown here, you can cut all the wood parts from two 1″ by 6″ boards 12′ long and two 1″ by 8″ boards 12′ long. Rather than buy materials, you can

A folding tongue keeps trailer level when unhitched from tractor. Body is an easily made box.





A brace hinged to top edge of box keeps tongue rigid. Locks are hinges with removable pins.

of course use lumber already on hand—and change the dimensions to suit.

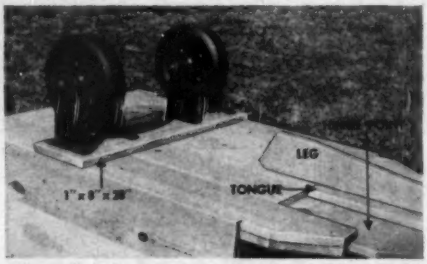
To assemble the parts, you'll need about six dozen 1¼" No. 8 flathead wood screws and a couple of pounds of 8-penny nails. Also get two doughnut-type wheelbarrow wheels with their mounting brackets and a suitable trailer hitch.

Building the box. Cleats hold together the side boards. Locate rear ones on the outside, forward ones on the inner corners. The bottom consists of four boards, two of them 8" longer than the other pair. The longer ones extend beyond the front of the box and support a 1" by 8" by 27" crosspiece to which the tongue is hinged. The short bottom boards stop at the forward edge of the box, allowing rear end of the tongue to swing up against the crosspiece.

Attach the wheels with bolts run through the mounting board and the bottom of the box. Placed under the box as shown, the wheels do not hit doorways or trees.

The tongue and brace. Construction of these parts is shown in the drawings. Use butt hinges to fasten them to the box. With the tongue in horizontal position, move the brace down and fit the small block that takes the strain put on the brace.

To lock the tongue, either up or down, loose-pin butt hinges are used. To lock the tongue in a raised position, both the brace and tongue are raised—and the brace then dropped over the latter. END



Outer floor boards extend 8" beyond box. Back end of tongue rests against the hinge board.

Plywood Case Protects Level

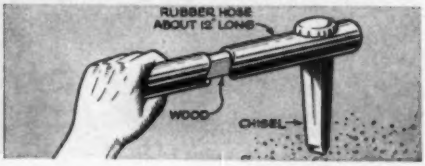
To PROTECT my carpenter's level and prevent breakage of the spirit glasses, I made the storage case shown. From five scraps of ¼" plywood, I formed a box with simple butt joints, glued and secured with brads. When figuring dimensions, I allowed ⅛" clearance.—*V. H. Lamoy, Upper Jay, N.Y.*

Fingers May Cause Bearing to Rust

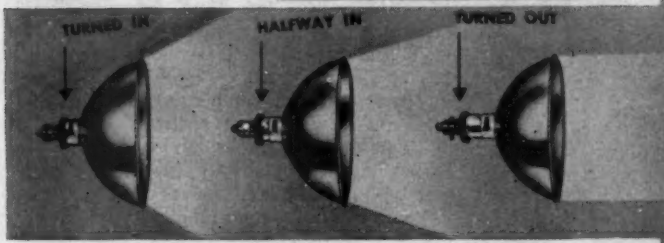
NEVER handle roller and ball bearings more than necessary. Tiny amounts of salty perspiration deposited from your fingers can start rust even if oil covers the bearing.

Rubber Hose Holds Cold Chisel

A FOOT or so of heavy rubber hose makes a good shock-absorbing handle for a cold chisel. Punch the chisel through the hose about an inch from one end. If the hose isn't rigid enough, insert a stick.—*Charles Zych, Chicago.*



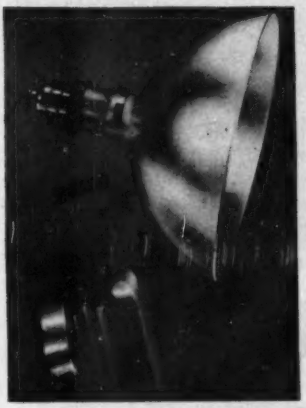
How to make wide- and narrow-beam flood shots with one lamp



wide beam for general still work

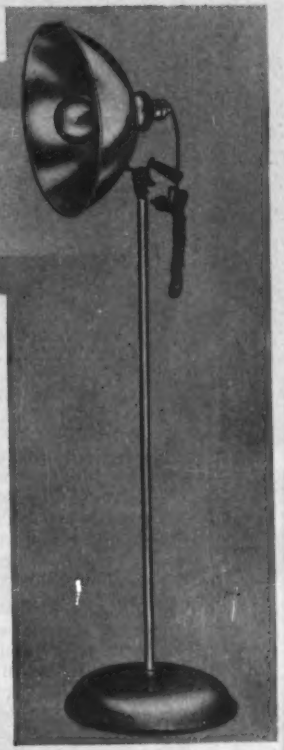
moderately narrow beam for your movies

extra-narrow beam for glamour shots



Kodak Vari-Beam Standlight *(right)*
As you see above, the versatile Kodak Vari-Beam system is mighty handy. 12-inch reflector with a #2 flood lamp gives powerful illumination . . . convenient handle aims the lamp . . . telescopic column adjusts height from 3 to 5½ ft. . . . special rubber rim on heavy base protects furniture. $15.

Kodak Vari-Beam Clamplight *(left)*
Lamp unit has all the features of the Vari-Beam Standlight unit, but is mounted on flexible bracket. Padded clamp attaches quickly and securely to chair backs, table tops, and tubular surfaces. $9.75.



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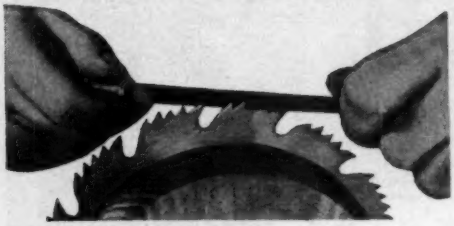

You can't beat the Nicholson or Black Diamond Slim Taper File for home-workshop combination circular saws*. (Handsaws, too, for that matter.) It has an even bite that never throws your filing stroke off stride. A shape that enables putting just the right point, edge and bevel on circular saw teeth. A hardness that keeps it cutting efficiently long after "cheaper" files are ready for the scrap heap.

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Gus Finds Two Rights Make a Wrong

[Continued from page 194]

"Now try the gas again," Gus called.

Frank doubtfully moved the throttle handle forward. This time, however, the engine progressed smoothly from idling up to a full-throated roar without a single break in her rhythm.

The three men made a composite picture of surprise. Frank just sat in the tractor seat dumbfounded. Mel stood looking slightly bewildered. Even Gus looked as if he couldn't quite believe his ears.

When Frank recovered, he began moving the throttle back and forth to make sure what he heard was true. Finally, convinced that the miss had disappeared completely, he shut off the ignition, slid off the seat, and stepped down to the barn floor.

"What the devil did you do?" asked Mel. "And whatever made you do it?"

Gus grinned. "I was a little lucky. I just happened to stumble onto two things and they happened to add up right," he replied, modestly. "First of all, since there didn't seem to be anything particularly the matter with cylinder No. 2, I figured that maybe some other cylinder was causing the trouble."

"But all the cylinders checked," put in Frank.

Luck and a Hunch Located Trouble

"Okay," agreed Gus, "but I had a hunch that maybe two rights were making a wrong. Now," he added, "the only connection between cylinders is through the intake and exhaust manifolds. Right?"

Both Frank and Mel nodded in agreement.

"Then," continued Gus, "the most likely cylinder that could have any possible effect on No. 2 is No. 1, because they both use the same halves of the manifolds. Since No. 2, for no good reason, was doing the missing, I figured that in some roundabout way No. 1 was starving No. 2 at speeds above idling.

"Also, since No. 1 was firing perfectly, it seemed most likely that if it was affecting No. 2 it was getting in its dirty work during its exhaust stroke."

"But how could that be?" interrupted Frank. "If the clearances were right, only the exhaust valve would be open on No. 1, and all the gases would pass out through the exhaust manifold."

[Continued on page 246]

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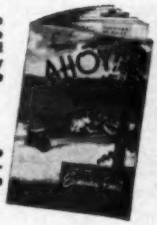

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Gus Finds Two Rights Make a Wrong

[Continued from page 244]

Gus nodded. "And according to this firing order," he added pointing to the numerals '1-3-4-2' cast into the engine block, "No. 2's intake valve would be open at the same time. I had a hunch that something was preventing No. 2 from getting her full supply of fuel and air."

"But what could do that?" asked Mel.

"I didn't have the slightest idea, Mel, until you happened to mention that Susie hadn't run too well when you first got her but that she'd settled down."

"I still don't get it," said Frank, puzzled.

"Well, I figured that the trouble must be connected with something that wasn't overhauled," explained Gus, "something that could open No. 1's intake valve when it shouldn't be open—like a little hump on the intake cam."

"A hump on the intake cam?" repeated Mel.

Gus Explains a Simple Fix

"Yes, if there was a little hump on the intake cam at just the right point, it could nudge No. 1's intake valve open just a crack during its exhaust stroke. That could build up enough back pressure in the intake manifold to prevent the full mixture from ever getting to No. 2 on its intake stroke at anything above idling speed. Might be one of those manufacturing defects that sometimes—rarely—gets by the factory inspectors."

"But how did you fix it?" asked Frank.

"Simple enough. I just backed the No. 1 intake valve clearance off a bit so the bump couldn't raise the intake valve. It's only a makeshift. It'll hold for now, but when you have a lull in your plowing, I wish you'd bring it down to the shop so we can grind that high spot off and readjust the valve."

Frank had little to say during dinner that Sunday. Then, as Gus was scraping the last bit of Mrs. Mowbray's apple pie onto his fork, the young hired hand said, "Something still bothers me, Mr. Wilson. How come old Susie didn't have a miss until I tried to fix her?"

"Just as I said," grinned Gus. "Sometimes two rights can make a wrong. Before you fixed her, her valve clearances were off enough so that hump on the cam didn't matter. When you ground the valves and made the clearances right, it did." END

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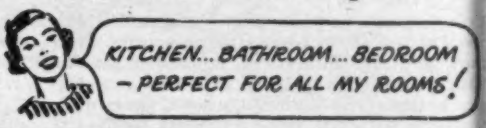

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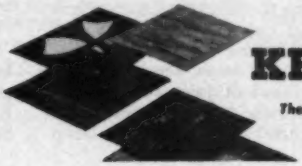

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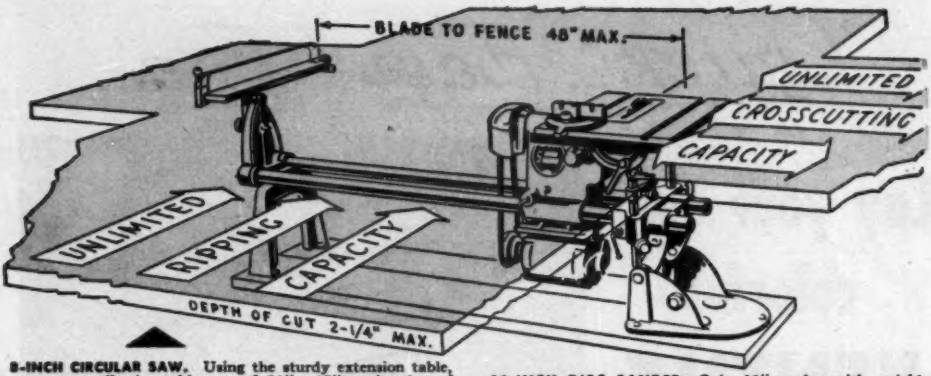
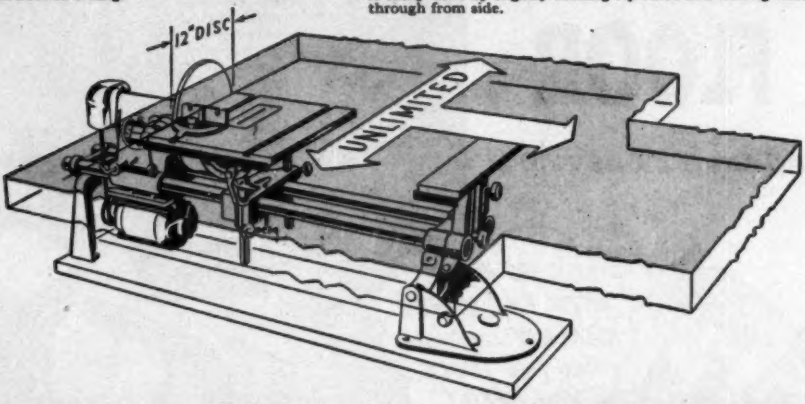


8-INCH CIRCULAR SAW. Using the sturdy extension table, you get an effective table area of 54" x 17"—twice that of the finest saws. Maximum blade to fence distance is 48"—the exact center of full-size plywood panels. Maximum depth of cut, 2¼". When table is tilted, crosscutting capacity extends from floor to ceiling.

12-INCH DISC SANDER. Only 12" sander with quickly changeable discs for different sanding grits. Disc can be fed into the work for maximum accuracy, speed and safety—can be set to stop on a hairline. Jointing to precise widths is easily done by slightly cocking rip fence and feeding work through from side.



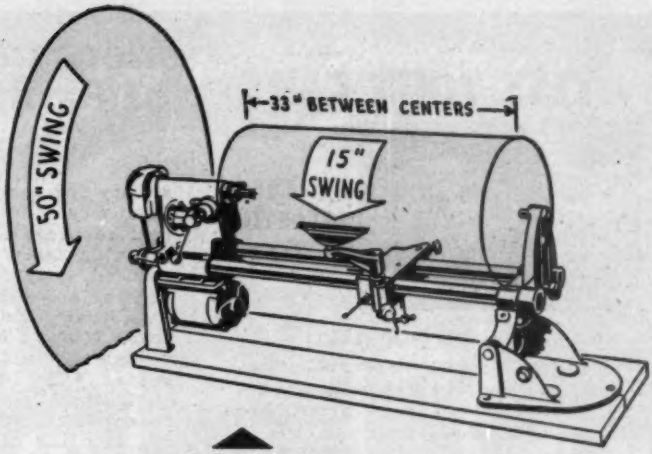
It's Shopsmith for CAPACITY

THE diagrams on these pages present dramatic proof of SHOPSMITH's tremendous capacity. They show you how SHOPSMITH, in each of its five basic positions, is designed to handle your biggest projects. How SHOPSMITH saws, sands, drills and turns with little or no restriction on the size of your work. How it converts—*in less than sixty seconds*—to the right tool for the job complete with time-saving jigs and extensions.

What does SHOPSMITH's great work-capacity mean to you? It means there is virtually no limit to the size work you can handle quickly and easily. You can saw to the center of full-size plywood panels . . . trim doors, screens, storm sash . . . accurately sand or joint room-length boards . . . drill or mortise oversize furniture or cabinet frames . . . turn table legs, bowls, lamp bases, table tops up to 50" in diameter . . . spin metal bowls up to 15" in diameter . . . do your own remodeling jobs . . . *build your own home.*

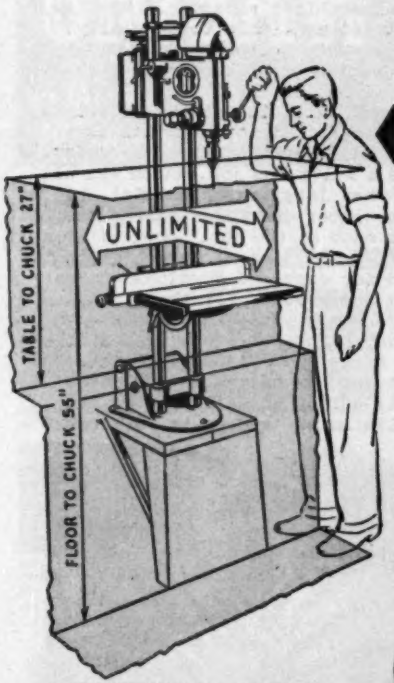
Yet for all its capacity, SHOPSMITH is compact—occupies only 2' x 5' of shop space. It's extremely accurate—has precision features and micro-adjustments found only in production-type tools. It's precision engineered to watchmakers' tolerances. It's completely flexible, exceptionally sturdy and rugged, weighs 200 pounds. It's no wonder, then, that SHOPSMITH is America's largest-selling power tool!

See SHOPSMITH demonstrated—at leading hardware and department stores or any Montgomery Ward store. And send today for your free copy of the information-packed, 16-page SHOPSMITH booklet.



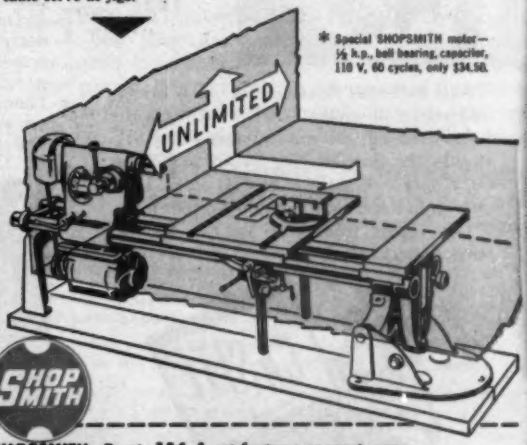
$189.50
COMPLETE
5-TOOL UNIT
WITHOUT MOTOR*

33-INCH WOOD LATHE. Capable of turning work up to 15" in diameter—4" more than most other heavy-duty lathes. 33" between centers. Headstock can be reversed for large-diameter outboard faceplate turning. Tool rest always slides parallel to work. Only lathe that lets you face your work while hollowing bowls or turning flat pieces.



VERTICAL DRILL PRESS. It's a bench model! It's a floor model! Drill to the center of a 15" circle. Jacobs key chuck takes drills up to ½" in diameter. Right or left-hand quill feed. Easy to read, adjustable depth scale. Spindle floats on *four* grease-sealed ball bearings. Rip fence and miter gauge provide convenient jigs.

HORIZONTAL DRILL PRESS. Makes easy work of drilling or mortising pieces too large or too awkward for vertical drill press. Just lay the work on the table, feed drill horizontally. Handy, too, for drilling flat pieces for doweled joints. Accuracy is automatic, since fence and table serve as jigs.

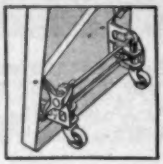


* Special SHOPSMITH motor—½ h.p., ball bearing, capacitor, 110 V, 60 cycles, only $34.50.

SHOP SMITH

NEW RETRACTABLE CASTERS

increase SHOPSMITH's already great flexibility. They're easily mounted on any wood or metal bench. Easy to set, too, with three-stage foot levers that raise or lower unit. Your SHOPSMITH dealer has them. Complete set . . . $11.95



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THE STARTING TEST

How fast can you start on cold, frosty mornings? Casite retards congealing of oil, lets the engine turn over and go at once. Casite *guarantees* Quick Starting or Double-Your-Money-Back!

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Notice any engine roughness, jerks, sputters? Casite gets rid of gum and goo, frees sticky valves and rings. Casite *guarantees* Better and Smoother Performance or Double-Your-Money-Back!

THE "MOLASSES" TEST

You'll find that finest motor oil is heavy and sticky as molasses when cold. Casite helps this oil get around fast—actually speeds the flow of No. 10 oil 24.3% at 50°F, more when the engine is colder. This cuts engine start-up wear, cuts repair bills.

Get Casite from your garage, service station or car-dealer.

FREE Write for your free copy of "Facts of Engine Life."

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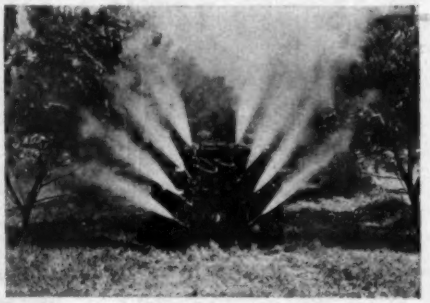
Casite Division, Hastings Ltd., Toronto

Mechanics of Farming

By Ladd Haystead

■ Very few harvesting machines get 100 percent of the crop, so now appear machines to work after machines. A cotton "after-harvester" is announced, patent applied for. The work of a Texas physician, Dr. William Rambo, and Roy Hanna of the Tulsa (Okla.) Tribune, it is said to salvage half the cotton now wasted. The 14-foot machine, drawn by tractor, jeep, or horses, has a rotary drum, spring-steel teeth that dig into the earth, rotary brush for cleaning cotton from teeth and throwing it back into receiver. Machine is not yet available commercially.

■ Spraying used to be a farm technique almost entirely limited to orchards. With the postwar development of chemical farming, its use spread all over the farm. Moreover, it was a multi-man job, which was all right when labor was plentiful, but postwar labor shortages showed machines must do the job. Now, after a lag of several years, during which demand far exceeded development, machines designed to fit the times and many jobs are appearing. One is the one-man, eight-jet, John Bean (Lansing, Mich.) Low Boy shown below. Insects on the underside of leaves as well as top are killed, two men are eliminated, and up to 70 acres a



day are claimed. The sprayers are also used for fighting farm fires, fly-control in dairies, cleaning farm machinery, weed-killing, etc.

■ Newest medical help for farmers is

DELTA MILWAUKEE

world's standard for quality power tools!

DELTA UNISAW

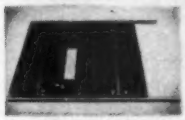
— the world's best 10" tilting-arbor saw

• Cuts 3 1/8" thick
• Rips to center of 50" panel

$254.00

Without motor or switch
Price subject to change without notice

Extra-plus Delta features like these mean MORE PROFITS to you!



Massive table is heavily ribbed to prevent warping.

Large hand-wheel controls easy to reach and operate.

High motor mounting permits use of safe, narrow saw slot.

Quick-acting table inserts fit in machined openings.

Auto-Set Miter Gage has individually adjustable index stops.

Rip fence locks at both ends for perfect alignment.

HERE are reasons why the Delta Unisaw is your best long-range investment. Modern design and precision manufacturing make every Delta Unisaw consistently accurate on continuous operation.

The Unisaw is safe and easy to operate — changes quickly from one job to another — low initial cost.

These 5 Delta Quality Features make every Delta Unisaw "Trouble Free"

1. **Lubricated-for-life Ball Bearings.** Double-sealed against harmful dust. No oiling necessary.
2. **Pre-loaded Bearings.** "End-play" is taken out, for greater accuracy, longer bearing life.
3. **Precision-bored Bearing Seats.** Bearings fit closely, are tightly held, cannot become loose.
4. **Precision-ground Shafts.** Run without "wobbling," assure accuracy.
5. **Dynamically-balanced Pulleys.** Run without damaging vibration.

See your Delta Dealer. He is listed under "Tools" in the classified section of your phone book.

. . . PLUS *Super-safe saw guard . . . true-running arbor . . . completely machined saw-carriage trunnions . . . easy-running raising mechanism . . . vibrationless 3-belt drive . . . cabinet-type base . . . other more-for-your-money features.*

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videognosis, using X rays and their televised images. City specialist and country doctor converse by telephone while both view pictures. Images are said to be better in some ways by video, because dark and light contrasts can be increased, and special parts can be magnified by focusing of transmitting camera.

■ Corrugated-board paper from chicken feathers is the newest use of a farm waste, and the pulp has been blended successfully with other fibers in producing a cheap-grade paper for commercial purposes, according to Mead Paper News.

■ A new, extra-rugged subsoiler, giving deep tillage penetration up to 18 inches, is announced by Harry Ferguson, Inc., Detroit. The tool, readily attached to the Ferguson system of linkage, eliminates need for special heavy equipment and breaks up compact and impervious layers of subsoil to permit growing of deep-rooted legumes that don't normally flourish with "wet feet."

■ A portable, durable, livestock scale for cattle weighing (or for field crops) has long been needed, but only now has one been produced by Georgia Tech. and Georgia Experiment Station. It is hydraulic and works on the principle of the jack in reverse, utilizing the fact that a liquid is practically incompressible and transmits pressure uniformly throughout any vessel. In this case the pressure activates a small, sensitive pointer on scale's dial. Rapid weighing of carts, wheelbarrows, or highway vehicles also may be possible with the new device.

■ Farm fires are estimated to cause a hundred million dollars' damage a year. Lack of equipment, water supply, and the time element contribute to the high loss. But Kent County, Mich., volunteers have gone a long way toward lowering the figure locally by using high-pressure fog units and carrying their own water instead of depending on wells, streams, or cisterns. Their records show that 87 percent of fires took less water than the 500-gallon truck capacity, little water damage resulted, and the fog protected firemen from heat, gas, and smoke.

GROBANS' ALL BRAND NEW WAR SURPLUS SPECIALS

ALL FULLY GUARANTEED

SELF PRIMING ALL PURPOSE PUMP

IDEAL FOR
- Draining Basements
- Insecticides
- Fuel Oil
- Vacuum Pump—28" for Milking Machines, Lab use, etc.

(ITEM #51A)

- Air Compressor—for Paint Spraying, etc. Delivers 4.5 CFM at 40 PSI with 1725 RPM.
- Home Water Systems
- 4-Ball Bearings—½" Shaft—⅜" Ports
- Rotate in either direction
- Rated up to 6 GPM, 50 PSI
- Use with ¼ HP motor or larger, speeds from 200 to 1800 RPM
- Useful for hundreds of applications in the home, farm and factory
- Built by Pesco—Div. of Borg-Warner. Gov't. acq. cost $45.00. Shpg. wt. 12 lbs.

FREE: Complete instructions and performance data with each pump. F.O.B. Chicago.
NOW ONLY **16.50**

GENERAL MOTORS-ALLISON CENTRIFUGAL PUMP

200 GALLONS PER MINUTE

(Item #130)

- For Draining Basements
- Fire-Fighting
- Irrigation
- Fuel Transfer
- Swimming Pools
- Home Water Systems
- Dewatering

This General Motors-Allison Centrifugal Pump—designed for use on U. S. Air Force Mustang fighters, now converted for commercial, home, and industrial high volume pumping applications. Inlet, 2½" standard pipe thread, twin outlets with 1¼" pipe thread, ball bearing supported ¾" shaft. Easy, fast, simple priming. Rotation, counter-clockwise facing shaft. Shipping wt. 35 lbs. Gov't acq. cost $145.00. F.O.B. Chicago
NOW ONLY **39.50**

Suction Lift	Head Pressure	Gal. Per Min.	H.P.	R.P.M.
10'	65'	200	9.2	3500
10'	80'	40	1.5	2500
10'	50'	140	5.0	3500
10'	30'	100	3.0	2500

HYDRAULIC CONTROL VALVES

ITEM #24. Four-way control valve with built-in relief valve, for use with one double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Ship. wt. 8 lbs. A $38.00 value postpaid **9.95**

(ITEM #24)

ITEM #26. Four-way control valve for use with two hydraulic double-action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Ship. wt. 6 lbs. A $60 value, postpaid **12.95**

NEW! STATIONARY OR PORTABLE D. C. ARC WELDER

250 AMPS. MODEL 252

FOR ANY WELDING JOB, LIGHT OR HEAVY

STOP COSTLY REPAIR BILLS, WELD IT YOURSELF AND SAVE

Only one or two jobs will pay for entire welder. Designed for many years of trouble-free service. This precision engineered Direct Current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly where and when you need it. Has dial type rheostat for easy pinpoint control and a high-low range switch. Run welder at 2500 RPM from drive pulley or power take-off of tractor. Is 7½ HP electric motor or a 10 HP gas engine. Use two V belts or flat belt (on pulley).

(Item #45)

Now . . . AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Shpg. wt. 107 lbs. F.O.B. Chicago. **99.50**
If more information is desired write for welder circular.

HYDRAULIC SPEED REDUCER

with FINGERTIP CONTROL

(ITEM #115)

USE FOR: • Reamer Drives • Midget Cars • Feed Mills • Canning Machines • Conveyors • Lathes • Milling Machines • Motor Boats • Cream Separators • Garden Tractors • Pumps • Blowers, etc.

Variable output speeds ranging from 0 to input speed now available. Merely move control handle until desired speed is attained. Then turn locking handle to maintain the setting. Internal relief valves prevent overloading. Use input power of ¼ to 1½ H.P. This Westinghouse-Oil Gear Unit converted to commercial use from 40 MM anti-aircraft traversing mechanisms consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. These components are contained in a crackle-finish steel oil reservoir (capacity 2 qts.). Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation.
Both input and output shafts measure ⅝" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speeds not to exceed 750 R.P.M. Over-all dimensions 7½"x7½"x11½". Gov't acquisition cost, $428.00. Shipping weight 26 lbs. Complete with 2 qts. of oil and full instructions F.O.B. Chicago **54.50**

Hydraulic Cylinders-Air or Oil

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient, smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.

ITEM #70—Purolator hydraulic oil filter. Permanent element type, ⅜" female pipe thread ports. Capacity, 16 gallons per minute. A $13.00 value. Now Postpaid **4.95**

ITEM #4—All steel double action hydraulic cylinder. 1½" bore, 2½" stroke. Clevis mounting. Will lift 1000 lbs. with 1000 P.S.I. line pressure. Perfect for positioning and feeding movements. Shpg. wt. 4 lbs.
Postpaid **4.95**

ITEM #33C—Double action hydraulic cylinder, 1½" bore, 4½" stroke. Clevis mountings at base and both ends. Uses ¼" pipe fittings. Postpaid **8.95**

ITEM #32—Double action, 1½" bore, 9" stroke, will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 4 lbs. A $45.00 value.
Postpaid **10.95**

ITEM #41—Double action hydraulic cylinder, 2" bore, 6" stroke, clevis mounting at base and end of shaft. Over-all length closed 12½". Has ⅜" stainless steel shaft, uses ¼" tube fittings. Will lift up to 3100 lbs. with 1000 P.S.I. line pressure. Weight 7 lbs. Postpaid **12.50**

ITEM #16C—Double acting hydraulic cylinder, 1½" bore, 26" stroke. Will lift 1760 lbs. with 1000 PSI line pressure. Weight 8 lbs. A $55.00 value. Now Only, Postpaid **16.95**

ITEM #103—Double acting hydraulic cylinder, 2½" bore, 17" stroke. Clevis mounting. Will lift 4900 lbs. with 1000 PSI line pressure. 1¼" diam. shaft. ⅜" tubing thread ports. Overall length closed 28". Shpg. wt. 11 lbs. F.O.B. Chicago **21.50**

(Item #42)

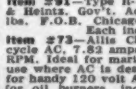
ITEM #31C—Double action hydraulic cylinder, 3½" bore, 11" stroke. Aluminum alloy cylinder wall and all steel 1½" piston rod. Clevis mounting at base and shaft. 19½" overall length closed. Will lift 9625 lbs. using 1000 PSI from Logan Heavy Duty Hydraulic Pump. Uses ⅜" tubing fittings. Value $102.00. Shipping wt. 11 lbs. F.O.B. Chicago **22.50**

ITEM #6-A—Double action hydraulic cylinder, 3" bore, 25" stroke, will lift 7070 lbs. with 1000 PSI line pressure. Steel barrel, 1½" stainless steel shaft. Gov't acq. cost $176.00. Shpg. wt. 26 lbs. F.O.B. Chicago **28.00**

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 PSI line pressure is 12,500 lbs. Ship. wt. 30 lbs. F.O.B. Chicago. An excellent Buy for **32.50**

HI-PRESSURE FITTINGS for cylinders and valves available at 50c ea. for ⅜" pipe and 65c ea. for ½" pipe.

DIRECT CURRENT GENERATORS



For welders, plating, truck and marine use. D.C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.

Item #131—Brand new Electric-Autolite 12 volt Direct Current electric generators, rated 18 amps. Complete with blower and pulley. Use for trucks, tractors, boats, battery chargers, etc. Part No. GEF-4805A. In original sealed U. S. Army cartons. Shpg. wt. 27 lbs. F.O.B. Chicago ..... Now Only **15.00**

Item #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't Acq. Cost $300.00. Shpg. wt. 70 lbs. F.O.B. Chicago **22.50**

Item #91—Type R-1, rated 300 Amps.—30 Volts, Mfd. by Jack & Heintz. Gov't. Acq. Cost $380.00. Shpg. wt. 70 lbs. F.O.B. Chicago **35.00**

Each individually packed in wooden box.

Item #73—Allis Chalmers MOTOR GENERATOR, 120 volt, 60 cycle AC, 7.82 amps. output. Input—24 volts DC, 63 amps. 3600 RPM. Ideal for marine and aircraft installations, farm and factory use where AC is desired and DC available. Run unit off DC welder for handy 120 volt AC current for emergency power for oil burners, incubators, electric motors, etc. Shipping wt. 200 lbs. F.O.B. Chicago **79.50**

LOGAN HEAVY DUTY HYDRAULIC PUMP

For operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 18 GPM at 1200 RPM at 1000 P.S.I. using 6 HP. Has a ⅝" inlet, ½" outlet, ⅝" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7" L x 9½" H x 5½" W. A $105.00 value FOR ONLY F.O.B. Chicago **22.50**

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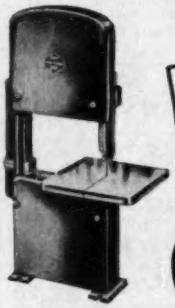
8" BENCH SAW *Only* **$33.95!**

With two extensions, as shown, **$38.90**

For home repairs and improvements, furniture, cabinets, shelving . . . for hobby work of dads and teen-age sons . . . for *fun with savings* . . . there's nothing to compare with these new Atlas Workshop tools. Each tool is backed by 40 years of Atlas precision engineering. They give your shop greater versatility *at less cost* than any tools or combination tool you can buy! Equip your shop now for the years ahead. Stocks are still available, but don't delay. See your Atlas or Atlas-Power King dealer today. Prices are the current ones, F.O.B. Kalamazoo. Send coupon for catalog with full details.

5 TOOLS POWERED BY 1 MOTOR



10" BAND SAW
ONLY . . **$42.50**

13" JIG SAW
ONLY . **$18.50**

Fast! Rugged! Accurate! Precision Designed and Engineered Throughout. Every Feature You Need for "Factory Quality" Workmanship!

4" JOINTER PLANER
ONLY **$28.75**

11¾" DRILL PRESS
ONLY **$37.50**

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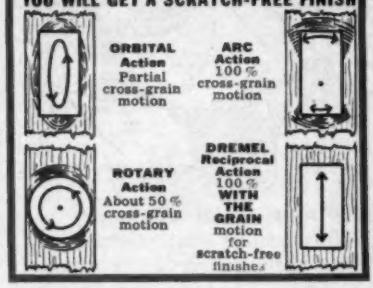
Three DREMEL Electric SANDERS

STRAIGHT LINE Action for Guaranteed SCRATCH-FREE Surfaces

BEFORE YOU BUY ANY SANDER—BE SURE YOU WILL GET A SCRATCH-FREE FINISH



OTHER DREMEL FEATURES (In both Model "A" and Model 2000)

Only 2 moving parts ● requires no oiling ● Easily Operated with only one hand ● cam-type holder permits paper change in seconds . . . operates on 110-120 v. 60 cycle A.C. . . . fully guaranteed.

MODEL 2000 $24.50

14,400 SANDING STROKES PER MINUTE

MODEL "A" $14.95

FOR HEAVY-DUTY CRAFT AND WOOD WORKING PROJECTS

The new Model 2000 is a fast-cutting production sander. It has the added stroke and power required for furniture and cabinet making, boat building or refinishing, resurfacing large area table-tops, sanding plastic, leather, etc. Great for building operations in sanding woodwork, stair treads, dry wall joints, siding and other exterior surfaces. Does a superb wax polishing job, too! Weighs only 5 lbs. yet has 21 sq. in. sanding surface. Over-all size 3⅛" x 4½" x 7". Model 2000 price includes steel carrying case shown, with 25 assorted sheets abrasive paper and 1 sheepskin polishing pad.

IMPORTANT

Before buying just any make of power tool, compare Dremel, feature for feature, with all competitive products. If you are not thoroughly convinced of Dremel superiority, we are sincere in saying we don't want you to buy.

FOR HOBBY WORK, REFINISHING AND REDECORATING . . . .

Dremel Model "A" Sander saves time and labor for hobbyists, home-owners and housewives. **Over a quarter million now in use** for sanding woodwork, cabinets, wood and plastic models, unfinished furniture, workshop projects, etc. Easy to handle—weighs only 2½ lbs. Takes all the drudgery out of polishing any waxed surface. Sanding pad 2¼" x 5½". Furnished with 6 sheets sandpaper, 1 sheepskin, 1 felt pad.

FUN FOR BOYS FROM 8 TO 80

DREMEL Electric COPING SAW

CUTS SCROLLS LIKE MAGIC—SANDS AS IT SAWS

FREE PROJECT PLANS . . . for 8 useful projects packed with each saw.

JUST GUIDE IT!

Only $5.85 with 3 saw blades

SAFE! AS A HANDSAW

For home, hobby, repair work—no other tool pleases so much for so little cost. Works in any direction—delivers 7,200 strokes per minute smoothly, effortlessly. Saws through ¾" medium-hard wood at a foot-a-minute speed. Touch-of-the-trigger, foolproof action. Only 2 moving parts, never needs oiling. Uses 110-120 v. A.C.

WHERE TO BUY DREMEL TOOLS

Dremel Tools are sold everywhere. If your dealer cannot supply you, send remittance in full and we will ship postpaid. Or send only $2, and pay postman balance plus postage and C.O.D. fee. **Money back if not delighted after 5 days' trial.**

DREMEL MFG. CO. MOTOR TOOL MACHINE MFR.

SAW SHARPENER

Table model, gums and sharpens rip saws, combination saws & cut-off saws. Ideal for "Skilsaw" blades. Cap. 4" to 20" diam. Complete with ¼ h.p. motor & 1 grinding wheel & cord—$64 f.o.b. Portland. Shipping weight, 63#. SEND FOR FREE LITERATURE.

P. T. HOBBS MACHINERY
5375 N. Interstate, PS-31, Portland 17, Ore.

How to Get Better Paint Results with One Coat

NEW FREE BOOK ON ALUMINUM PAINT TELLS HOW

Write for your free copy of 24-page illustrated fact-packed book, "Paint it Bright". Prepared by Alcoa experts to help you get best paint results. Absolutely free—no obligation. Write to:

ALUMINUM COMPANY OF AMERICA
1717C Gulf Building, Pittsburgh 19, Pa.

NO CAR SHOULD BE WITHOUT ONE!

CASCO VIS-O-LITE

Illuminated Automatic

CIGARETTE LIGHTER

Why be without the convenience of this great new Vis-O-Lite illuminated lighter that makes driving safer day and night? You can replace your old lighter with a new Vis-O-Lite in a matter of minutes with pliers and screwdriver . . . and get the advantages of an illuminated lighter-wall that ends fumbling in the dark, prevents scratching dashboards. Made by the manufacturers of the original pop-out lighter that's standard equipment on 4 out of 5 cars. Costs only **$2.75** complete. The illuminated wall-assembly alone (minus the pop-out unit) costs only **$1.25.** Now on sale at Car Dealers, Auto Supply Stores and Service Stations.

NO HOBBYIST SHOULD BE WITHOUT ONE!

LOWEST PRICE EVER... *for a* CASCO

only $9.95

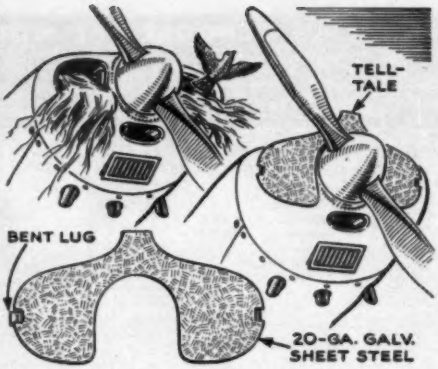
NEW CASCO-CRAFT 14 Pc. Kit

A complete, practical power-workshop for craftsmen, hobbyists! Has accessories to drill, cut, etch, carve, grind, buff, sand, engrave and sharpen – metal, wood, glass, leather, plastic and fibre. 1001 year-round money-saving uses. AC and DC. *At Dept., Hardware, Appliance, Jewelry Stores.*

WRITE FOR NAME OF NEAREST DEALER

CASCO PRODUCTS CORPORATION
BRIDGEPORT 2, CONNECTICUT

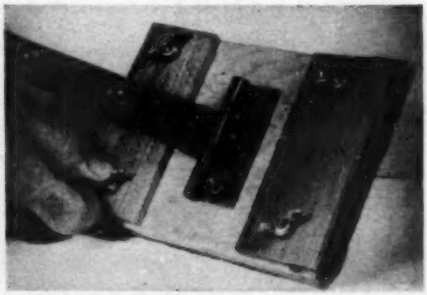
CASCO



Bird Nests Peril Small Airplanes

SMALL birds—such as sparrows—frequently build their nests on top of the cylinder banks of airplanes. The birds enter through the air intakes. Their nests pack the space where air should flow. A ruined engine or a fatal fire can result if the nests are not removed. In one 10-day period, I removed four nests from my Aeronca Chief.

To keep the birds out of my plane, I designed the shield shown in the drawing. It's made of 20-gauge sheet steel. The lugs engage the lips of the air intakes to hold it in place. The telltale lug can be seen from the pilot's seat to remind him to remove the shield before a flight.—*Stewart Rouse, Knightstown, Ind.*



Make This Low-Cost Waxing Aid

IF YOU bought a combination scrubber-buffer like this it would cost you about $3. I built this one for about 40 cents.

The base is a piece of scrap wood ½" by 5" by 7". A strap hinge—bolted to the base—joins the base to a broom stick. The two small pieces of wood at each end are clamped down by wing nuts to hold the ends of a steel-wool pad or a wool buffing pad.—*Oliver C. Grant, Springfield, Mass.*

BUY DIRECT-BRAND NEW-UP TO 85% DISCOUNT

Portable LIGHT PLANT

PUSH BUTTON START

500-700 watts 110-120 v. — 60 cyc. A.C. Powered by a sturdy dependable, easy starting, air cooled 1¾ hp. gas engine. No wiring necessary, just plug in and operate. Plenty of current for most oil burners, emergency lights, freezer, radio, incubator, etc. Ideal for trailers or camping. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Wt. 85 lbs. Fully guaranteed. **Be prepared if war or storm knocks out power lines.** Reg. $275.00 value..... **$143.50**

(Item 24)

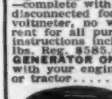
GIANT 2000-2500 WATT PLANT

(Item 31)

110-120 V. 60 cyc., A.C. **Absolutely the best made** because its heavy windings develop up to 5000 watt overload for motor starting. Skid-mounted—portable. Powered by 5 h. p. easy starting Briggs engine—complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty and instructions included. Wt. 220 lbs. Reg. $585.00. Spec. at. **$299.50**

GENERATOR ONLY and control box. Drive it with your engine or tractor..... **$169.50**

EXTENSION CORD



(Item 16) 40 ft. heavy duty, made of specially insulated No. 14 2-conductor wire. So tough that you can drive over it and yet amazingly flexible and easy to handle. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Use indoors or out. Complete with heavy rubber plug and outlet. Wt. 2½ lbs. Usually $4.50—Special 40 ft. **$1.98** Comb: 2-40 ft. and 1-20 ft. (total 100 ft.) **$4.95**

PRESSURE SWITCH

(Item 30) Penn Electric Model 110 BPO2, best made. For pumps and air compressors. Heavy duty. Will handle up to 250 lbs. press. and up to 5 h. p. Autom. unloader valve, for easy starting. 110-220 v. A.C. or D.C. 2 pole. Wt. 5 lbs. Reg. list $17.50. Our Spec. **$8.95.**

HOT WATER HEATER

(Item 26) Immersion type, heavy duty, 115v. A.C. 300w. Does not require watching. Thermostat shuts off at 165°. Keeps water hot for shaving, washing dishes, etc. Also good for keeping water from freezing in big troughs or tanks. Made by Cities Service. Wt. 4 lbs. Worth $9.50. Our Spec. **$4.50.**

GAUGE TESTER

(Item 27) Precision made of solid bronze by Star Brass Co. Calibrated weights (incl.) acting against hydraulic piston, provides quick accurate testing of all pressure gauges up to 3000 lbs. per sq. in. Brand new in hardwood cases. Wt. 100 lbs. Reg. $435.00. Our Spec. **$135.00.**

ELECTRIC HAND SAW

(Item 36) Most perfectly balanced and smoothest running saw made. Advanced design provides max. power and light weight. Easily adjusted for all angles, depth and width of cut. Comes complete with 6½" comb. blade, ripping guide and 16 ft. hvy. duty cord. Built-in sawdust blower. Autom. telescoping guard. 110-120 v. AC-DC. Depth of cut 2⅛". 1 year written guar. Wt. 12 lbs. Drastically reduced. **$39.95.**

ANGLE DRILL

(Item 23) Fits into chuck of any electric or pneumatic drill or flex. shaft. **Operates at any angle in a full 360° arc.** Makes possible drilling, grinding, carving, routing, etc. in close cramped quarters. Makes impossible jobs easy. Made by Kett Tool Co. Complete with built-in chuck (¼" capacity) and adjusting key. Hardened alloy gears. Precision built for heavy duty. Lists at $39.95 — while they last **$6.95.**

CARRY-AIR

Stainless steel tank — capacity 500 cu. in. at 400 lbs. press. Complete with valve and shut-off valves, press. gauge, detachable air hose, tire chuck. Full at any service station. Carry air for tire inflation, blowing out lines, spray painting, insecticides, etc. One emergency pays back cost. Wt. 15 lbs. Worth $20.00. Our price—**$8.95.** (Item 32).

SPRAY OUTFIT

(Item 37) Twin cyl. piston type compressor direct-connected to powerful 110-120 v. AC-DC motor. Built-in air tank eliminates pulsation and provides steady flow of air at 25-30 lbs. Sprays lacquers, enamels, insecticides, etc. Does beautiful work on autos, furniture, farm equip. 1 qt. spray gun, relief valve and 10 ft. air hose incl. Full instructions and 1 year guar. Wt. 11 lbs. Easily worth $50. Spec. **$22.95.**

PARTS WASHER

(Item 29) Store gas or carbon tet. in 5 gal. safety can. Valve releases just the right amount into washing compartment. Parts are washed and drained on a "dunking" screen — no fishing for parts. Eliminates fire danger, waste, spillage, evaporation. Wt. 14 lbs. Reg. $19.50—Special **$5.98.**

RUBBER HOSE

New neoprene Hose outlasts ordinary rubber 3 to 1. Reinforced with super tough cotton cord plies. Flexible. Easy Flo brass couplings with standard pipe threads for quick connections, included. **Pump water for irrigation, stock tanks, home, barn, fire fighting, etc. Pump Gas or Fuel Oil. Save more than 60%.**

Diam.)	1½"	1½"	1½"
Length	25 ft.	40 ft.	50 ft.
Price	9.25	14.75	14.75

If specified we will send special hose for gas or oil at same prices.

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range, removes kitchen smoke and odors. Powerful continuous duty motor, 110-120 V. A.C. Quiet, super efficient fan moves huge volume of air (400 to 600 c.f.m.) 8" Fan (6" blade), wt. 5 lb. **$6.35;** 9" Fan (6" blade), wt. 6 lbs. **$7.45;** 10" Fan, (8" blade), wt. 7 lb. **$8.46;** 12" Fan (10" blade), wt. 8 lbs. **$9.45.**

½" DRILL

(Item 33) DeLuxe model—powerful, smooth running, precision built. Handles toughest jobs. Cutler-Hammer switch. Jacobs key chuck. 110-120 v. AC-DC 300-450 rpm. Alum. alloy case for high strength and easy handling. Built-in blower assures cool operation. Cap. ½" in steel. 1 year drills guar. Wt. 11 lbs. Compares with $65 drills. Special **$34.50**

¼" DRILL

(Item 34) Hi-power, long-life, smooth running. Alloy steel gears; built-in blower. Cutler-Hammer switch. Jacobs hand-tite chuck. 110-120 v. AC-DC 1000-1600 rpm. Cap. ¼" in steel. 1 year guar. Wt. 4 lbs. Terrific value at **$12.95.**

38 Pc. DRILL KIT

(Item 35) Includes above illus. guar. drill, buffers, polishing bonnet, sanding discs, grinding wheels, wood bits, steel bits, wire wheels, bench stand, paint mixer burrs. Complete in heavy steel case. Wt. 13 lbs. 38 pc's., all highest quality. Complete kit worth $38.50. Our Spec. only **$19.95**

FRAM OIL FILTER

(Item 12), Model P21, Big 73 cu. in. size. Ample capacity for all cars, trucks, tractors. Universal bracket, standard openings. Fram filters are tops. Easy to install. Wt. 6 lbs. Usually $7.95—now **$3.75.**

HYDRAULIC HOSE

High pressure, heavy duty, complete with swivel fittings. Pipe thread connections. Ideal for farm equip., bulldozers, grease guns, airbrakes, etc. Any length. Minimum $1 per item. INSIDE DIAMETER. ¼" **30¢** per ft. ⅜" **60¢**, ½" **80¢**, ⅝" **90¢.**

CLIP BOARD

(Item 17) Heavy Masonite, with self-adjusting spring hinge to hold up to 100 sheets of 8½x11 paper. Push back cover for instant release. Flip cover shut and notes or drawings are protected. Perfect for pilots, engineers, students, artists, truck drivers. Wt. 2½ lbs. Usually $2.95. Spec. **$1.10, 2 for $2.00.**

MANUFACTURERS AND JOBBERS — write us about your surplus items

All items *brand new*. Prices f.o.b. Chicago area. Money back guarantee. Send check or M. O.

MASTER MECHANIC MFG. CO., Dept. 38, Burlington, Wis.

DRAINS Cellars, Wash Trays; CIRCULATES Oil; IRRIGATES Gardens

ORIGINAL "Type P" Pump has 1,001 year 'round uses—home, shop, garden, farm. DRAINS cellars, cisterns, wash tubs, ditches, pools. IRRIGATES gardens, lawns. CIRCULATES oil, coolant. SUPPLIES water to elevated tanks from wells as deep as 25 feet. 2400 gals. per hr. capacity. 360 GPH 75' high. 1500 GPH from 25' well. 1" suction and ¾" discharge ports fitted for hose. Quiet, noiseless operation. Use ½ to ¼ HP motor. Easily installed. Complete instructions furnished. DOES NOT CLOG OR RUST!

ONLY $6.95

postpaid if check or money order with order.

WHICH OF THESE 4 PUMPING UNITS DO YOU WANT?

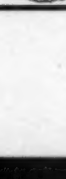
Easy to Assemble! Easy to Use!

"LITTLE GUSHER" Pump irrigates, drains, waters live stock, fights fires! Pumps 2,000 GPH 25' high or 360 GPH 75' high. Has ¾ HP engine with 3" power take-off V-pulley. Engine adjustable from 1700 to 4500 RPM. Portable—only 26 pounds. Dollar for dollar, pound for pound, the best pump value at **$59.00**

TYPE C-4 Pump has Direct Drive. Ideal for plumbing fixtures below sewer line. Complete with ¼ HP motor $23.45. Without motor, only **$11.55**

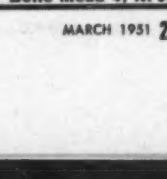
TYPE D-3 Pump cleans 40' well or cesspool quickly! Operates in any position. Pumps 400 GPH 40' high or 1400 GPH 20' high. Complete with ½ HP motor **$27.95**

Without motor, only **$12.95**



TYPE E Pump has interchangeable direct or belt drive for all 'round use. E-4 fitted with 5" pulley. Complete with ¼ HP motor. $24.95. Without motor, only..... **$13.95**

E-3 fitted with 6" pulley. Complete with ⅓ HP motor, $26.95. Without motor, only..... **$14.35**



MONEY BACK GUARANTEE

All Bronze Foot Valve for 1" hose.... $2.95
1" Suction Hose—per foot..... .38
¾" Discharge Hose—per foot..... .32

All prices POSTPAID if check or money order with order. West of Mississippi, add 50c for Type P; $1.00 for other models.

LABAWCO PUMPS • Belle Mead 4, N. J.

New kind of SAW BLADE

Takes the Danger Out of Circular Sawing

New PTI Safety Saw Blade is the original safety saw blade that eliminates all dangerous "kick-backs" from circular sawing—as proven by extensive tests at government and university laboratories in the United States and Europe. Thousands of delighted users in industrial, school, government and home shops—hail this as greatest circular saw improvement!

New PTI Safety Saw Blade Cuts on Entirely New Principle

Each P T I Saw Blade has only 8 teeth instead of the customary 100. These teeth project only 20/1000" above a non-cutting edge. Thus the cut of each tooth is "controlled" by the non-cutting edge, in contrast to the ordinary saw blade where each tooth cuts right down to its base. This basic change revolutionizes performance of the saw blade.

Offers Many Advantages

1. Complete Safety from Kick-backs; 2. Reduced possibility of direct injuries; 3. Cuts Chips, not Sawdust; 4. 30% to 40% Power Saving; 5. Longer Life Without Sharpening; 6. Smoother Cutting; 7. Quieter Running; 8. Less Danger of Blade Cracking.

Ask For Demonstration

PTI

If your dealer cannot supply you — you can order direct. Prices are for special Vanadium Steel blades, combination rip and cross cut, delivered, postpaid.

7" dia. blade $4.95	12" dia. blade $ 9.40
8" dia. blade $5.90	14" dia. blade $11.40
10" dia. blade $7.50	16" dia. blade $14.00

(Prices on carbide tipped blades furnished on request.)

INCORPORATED Dept. PS3
401 Broadway, New York 13, N. Y.

Gentlemen: Send me the following units:

Quantity Blade Diameter Blade Bore

Please check:
_____Money order or check for $_____ _____Send C.O.D.

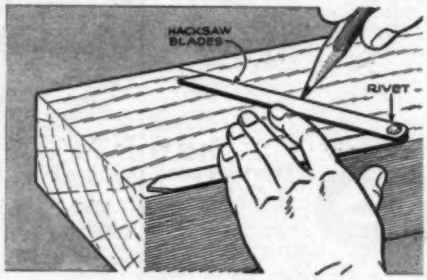
Name_____

Address_____

City_____Zone_____State_____

Bevel Gauges from Hacksaw Blades

I FIND several bevel gauges—with legs of different lengths and ends of different shapes—very useful in my shop. I use them for setting molding cutters and for testing the cut. You can also use them to transfer angles from a sample or drawing to your work. To make them, grind the teeth off broken hacksaw blades and use the holes in the blade ends to rivet them together. Make them a snug friction fit. Shorten the blades by grinding to suit a particular job. —*Noble E. Peeler, St. Paul, Minn.*



Snaps Repair a Leaking Boot

MY TACKLE box always holds several of the snap fasteners used on men's clothing. When my boots get a pinhole leak, I make a quick and substantial repair by sticking the male end of a snap through the leak from inside and snapping the other part over it. If it isn't a tight fit, I back the inside half of the snap with a stone and tap the outside half several times with another stone. This makes the halves grip tightly.—*John Krill, North Lima, Ohio.*

THE MOST *Versatile* TOOL ON YOUR BENCH!

CHANNELLOCK PLIERS

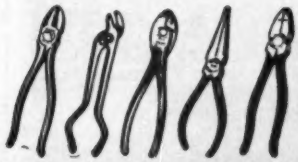
Made only by CHAMPION DEARMENT

In almost any job you can think of—Pliers are necessary—and Channellock pliers are the best you can buy. Whether you are working on your car, electrical repairs, plumbing work or just tightening nuts and bolts Channellock pliers do it better.

And remember, Only Champion DeArment makes Channellock—More than 3/4 of a Century of experience in producing highest quality tools. Send for Catalog 14,—today.

Channellock pliers are listed in the Yellow Pages of most Telephone Directories under "Tools"

CHAMPION DEARMENT TOOL CO.
Meadville, Pa.



ONLY Champion DeArment makes

CHAN NEL LOCK

HARD ARKANSAS*

a NORTON® abrasives
"NATURAL" STONE

For generations the selection of surgeons, dentists, woodcarvers, engravers, for the final refinement in edges. HARD ARKANSAS is purely a finishing stone. It takes over where other stones leave off—and what an edge it gives you! . . . in slips and bench sizes.

HARD ARKANSAS Round Edge Slip #HS-4, 4" x 1¾", $2.70, and HARD ARKANSAS Bench Stone #HB-6, 6" x 2" $9.00, at most hardware stores.

GET THE "HOW TO SHARPEN" BOOK
32 pages of pictures and data on professional tool sharpening. Send 10c to Dept. PS-3.

*Trade Mark

BEHR-MANNING
TROY, N. Y.
Also Manufacturers of Abrasive Paper and Cloth

NEW SAFE SAW
CUTS ONE INCH WOOD

50% FASTER with 70% LESS NOISE

No. 201 only $22.95

New Improved

SYNCRO ELECTRIC JIG SAW

Here's the largest, most powerful, most versatile jig saw of its kind . . . yet safe for children! Perfect for Dad's workshop! NOW 70% quieter operation with 50% MORE power. Cuts any length 1" wood, thin metal, plastic. Precision-built to last a lifetime. 14,400 safety strokes a minute. Portable. Use anywhere—even apartments! Just plug in and saw. Not a "lumber" cutter, but for fine, delicate craftsmanship. ENTIRE JIG SAW (not just the cord!) listed by UNDERWRITERS' LABORATORIES, INC. and Power Unit GUARANTEED BY SYNCRO all during your ownership against burnout or replaced Free! Buy with confidence. COMPLETE with BUILT-IN Fractional Horsepower Reactor Type Electric MOTOR, 3 Blades. Cord and Plug. $22.95 at dealers. If Dealer hasn't it, send $22.95 direct, we'll ship Saw postpaid.

SYNCRO CORPORATION
DEPT. G-31 OXFORD, MICH., U.S.A.

MOST POWERFUL
6" ELECTRIC SAW
YOU CAN BUY!

6"
Heavy-Duty
LECTRO-SAW
only
$56.50
Cuts to 2" depth

Also 8"
Heavy-Duty
LECTRO-SAW
$92.50
Cuts to 2 13/16" depth

Crosscutting

Cutting Tile, Transite, Slate

Ripping

Angle Cutting

Saves Time, Money in Building, Altering

HERE'S PROOF: The 6" Heavy-Duty LECTRO-SAW so outclasses other 6" saws that we matched it against two competitive 8" *electric saws* in a mechanically-controlled speed ripping test. The other saws cost *$30 more.* Yet LECTRO-SAW matched the speed and power of one and conclusively beat the other!

RESULT: The LECTRO-SAW speeds up general carpentry, home construction and alterations, farm building and maintenance. Ten times faster than hand sawing. Power, speed and ease of handling almost unbelievable in a low-priced Saw!

REMEMBER: LECTRO-SAWS are quality-built by BLACK & DECKER, world's largest Portable Electric Tool maker. So you can count on them for long service. See one demonstrated today at your hardware, building, electrical or implement dealer!

Products of HOME-UTILITY Div., The BLACK & DECKER Mfg. Co., Dept. H35, Towson 4, Maryland

Professional Saws at Popular Prices

ELECTRIC LECTRO-SAW SAWS

AMAZING NEW
WOOD-TURNING
TOOLS! Outlasts Steel Up to 50 to 1!

SHARPEN ONCE IN 12-YEARS!
(UNDER NORMAL USE)

These remarkable tools tipped with TUNGSTEN CARBIDE will astound you with their performance. They work FREE HAND equally well in wood, plastic or soft metals—and at the same time hold their razor-like edge almost indefinitely. Tests show that they will turn wood or plastic for days and days CONTINUOUSLY without showing any signs of dulling. They are the finest tools available at any price. Beautifully finished 5" blade—flush ground, polished tip—finest brass tube ferrule—9" hardwood handle—over all length 14"—25 tools to choose from: round & square nose from 1/4" to 1/2":—1/2 and 3/16 cut off: 1/2"x30° skew, spear, r. & l. skews, turning and parting. Amazingly Low Prices! Write at once for free literature.

JOHNS MFG. CO., DUNELLEN 5, N. J.

Furnace Repaired with Key Rings

SPLIT key rings make useful fasteners on the control system of a coal-burning furnace. They have sufficient expansion for threading through holes and, having no butt joints, will not open with time. The photos show two key rings linked together to serve as a fire-door handle and a single ring used to fasten the chain to the main-draft door. The rings are also handy for splicing breaks in chains at points where no pulley interferes.—*A. C. Porter, South Bend, Ind.*

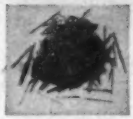
Engage Starter in Cold Weather

STIFF lubricant may keep a Bendix-starter pinion from engaging the flywheel during cold weather. This allows the starter to race without cranking the engine. If your car gives such trouble, push the starter button momentarily when you park it. Hit the button just enough to engage the gear, but not crank the engine. This puts the starter in position to function.—*Leroy W. Austin, Pattonville, Mo.*

Ammonia Aids in Cleaning Oven

CLEANING the oven of a kitchen stove is an easier job if you first soften and loosen burnt grease or spilled juices. When the oven has cooled, put a small saucer of ammonia in it, shut the door, and leave overnight. The ammonia fumes will do the rest. —*R. M. Woodbury, Natick, Mass.*

SURPLUS MACHINE SHOP TOOLS AT PRICES YOU CAN AFFORD



DRILL BIT MIX
Over 300 pcs. (2 lbs.) of used High Speed Drill Bits up to 1/4". Some require sharpening. Ideal for pin punches, drift pins, etc. Less than 1c ea. at..... **$2.98**

SET 2L 10 Different Size High Speed Straight Shank Drills from 1/4 to 1". Extra Long Drills. $40 value. New and slightly used surplus **$6.95**

HIGH SPEED MORSE TAPER SHANK DRILLS

SET 3L 20 Different Size High Speed Morse Taper Shank Drills from 1/4" to 1". $70 Value. Priced at only..... **$12.95**

SET 4L 10 Different Size High Speed Morse Taper Shank Drills from 1/2" to 1 1/16". $50 Value. Priced at only **$9.95**

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SET 6L 20 Different Size High Speed Morse Taper Shank Chucking Reamers up to 1/2" with No. 1 and 2 tapers. Priced at only **$6.95**

SET 7L 8 Different Size High Speed Morse Taper Shank Chucking Reamers from 1/4" to 1". Priced at only..... **$4.95**

SET 8L 10 Different Size High Speed Morse Taper Shank Chucking Reamers from 1/2" to 1 1/2". $65.00 value Priced at only..... **$9.95**

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SET 9L 20 Different Size High Speed Straight Shank Chucking Reamers up to 1/2". Priced at only..... **$6.95**

SET 10L 10 Different Size High Speed Straight Shank Chucking Reamers from 1/2" to 1 1/2". Priced at only..... **$9.95**

SET 11L 15 Different Size High Speed Straight Shank Chucking Reamers from 1/4" to 1". Priced at only..... **$6.95**

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SET 12L 7 Different Size High Speed Slitting Saws 2 3/4" dia. x 1" arbor. Thickness from .040 to .071. Cuts wood, aluminum, brass, steel, etc. $25 Value. Priced at only..... **$4.95**

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SET 13L 10 Different Size High Speed Standard Thread Hand Taps up to 3/4" including 2 std. High Speed Pipe Taps **$2.95**

HAND REAMERS & TAP HANDLE
SET 14L 10 Different Size Hand Reamers from 1/4"-1". Majority Brand New Plus No. 6 Tap Handle (5/32"-3/4" Cap). $30 Value. Only..... **$9.95**

SET 15L 20 Different Size Hand above with Same Tap Handle. Only **$16.95**

8 BRAND NEW CARBON HAND REAMERS
SET 16L From 1" to 1-13/16" including 1 No. 11 Taper Pin Reamer and 1 Large Carbon Expansion Reamer, all for..... **$19.95** F.O.B. Tulsa

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SET 17L 8 Different Size from C2 to M1 (1/16" drill x 13/64" body to 7/32" drill x 3/8" body) 60 degree of Countersink. These New Countersinks Sell New from 75c to $2.50 each. Your price for this set of 8, while they last, only..... **$3.95**

TAP HANDLE
No. 6 (5/32" to 3/8" Cap). Only..... $3.19

BRAND NEW REX HIGH SPEED TOOL STEEL BITS

1/4 x 1/4 x 2 1/2"	10 pieces	$2.29
5/16 x 7/16 x 4"	6 pieces	$1.85
3/8 x 3/8 x 3"	6 pieces	$1.85
1/2 x 1/2 x 4"	4 pieces	$1.95
3/4 x 3/4 x 4 7/8"	2 pieces	$2.49
7/8 x 7/8 x 5 7/8"	1 piece	$1.95

Cut Off Blades

1/8 x 3/4 x 6"	ea.	$1.49
1/8 x 7/8 x 8"	ea.	$1.49
3/16 x 1 x 8"	ea.	$1.79
3/16 x 1 1/8 x 8"	ea.	$1.89
1/4 x 1 1/4 x 10"	ea.	$1.95

Discounts on Quantity

HIGH SPEED MILFORD HACK SAW BLADES
These blades are so slightly used that they are practically new. Sold with usual money-back guarantee.

	Price ea.	Price per doz.
14 x 1 1/2 x .065 x 6 Tooth	$ .50	$ 5.75
18 x 1 1/2 x .072 x 6 Tooth	.75	8.00
21 x 2 x .072 x 4 Tooth	1.00	11.00
24 x 2 x .072 x 5 Tooth	1.25	13.00

BRAND NEW PUMP & MOTOR

Pump has 1" connections, built-in relief valve, adjustable up to 1500 lbs. 1 1/2 H.P. 24-volt motor. Can be used on 12 or 36 volts. 500 units available at quantity discounts. Both pump and motor only..... **$12.95**
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Three independent pump sections running off of one shaft for single or multiple pumping. Use one as a vacuum pump capable of drawing 25 inches of mercury. The other one or two pumps can be used as a power for sprayers, basement drain, stock watering, etc. Each section rated at 10 GPM at 40 PSI. Comes complete with mounting base and 4" drive gear. Only..... **$8.95**

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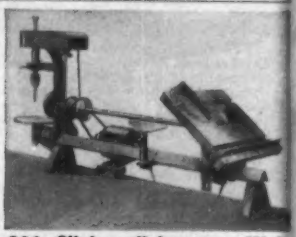

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It's the finest, precision built heavy duty transformer-welder available for home, farm, or shop use. Does work you'd expect from costlier machines. EASY TO OPERATE. Do expert work; follow simple instructions Works on iron, steel, brass, bronze, aluminum and other metals. Operates from any properly wired 110 volt 50/60 cycle AC line Save time, Make money—Build or repair auto, home, farm or shop equipment, etc. for yourself and others in spare or full time Comes complete Ready-To-Operate Order today for 10 day trial on money back guarantee or write for Free Particulars.
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"I rented a two-car garage and have all the work I can do. Some days I start 6:30 in the morning. I get work 20 and 30 miles from my place of business."
—Charles H. Smith

Buys 3 Foley Filers in Year and a Half
"Since I started out with my Foley a year ago last June I have progressed so nicely that I now have a fully equipped saw shop with three Foley Filers."
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FOLEY FILED SAWS BRING NEW CUSTOMERS

Here is a steady repeat CASH business you can start in your own basement or garage in your spare time. Every saw you sharpen with the machine accuracy of the Foley Saw Filer is an ad that brings more customers. S. M. Hollingshead wrote to us: "I am doing very well with my Foley Filer, and I am glad I invested in your machinery. It is very satisfactory and works very well in the small community in which I live."

You can file all hand saws, also band and crosscut circular saws on the Foley Saw Filer. The adjustments are simple—there is no eyestrain—and you can start right away to turn out perfect cutting saws. "The first saw I sharpened with my Foley Saw Filer came out 100%. I think it is a marvel of perfection."—writes Clarence E. Parsons.

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Send me free book **"INDEPENDENCE AFTER 40!"**

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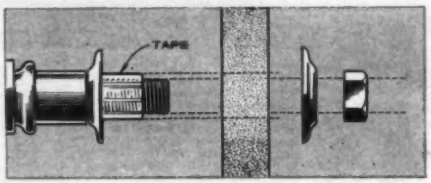
Address.....

Sprinkler Waters Lawn or Subsoil

THIS sprinkler—called the Waterspike—can be used in two ways. The 12" spike is inserted in the ground and the valve set either up or down. With the valve turned up, the top of the soil is sprinkled. With the valve turned down, the water is diverted to the spike where it flows out underground holes to irrigate the subsoil.

The aluminum-alloy propeller on top of the spray head is whirled around by water pressure to break up the jets into a steady spray. The head is designed so a square area instead of a water-wasting circle is sprinkled. It is made by Production Engineering Co., Berkeley, Calif.



Cellulose Tape Centers Grinding Wheel

IF YOU have to use a grinding wheel with an oversize hole, you can help center it by winding the shaft with cellulose tape, as shown in the drawing. Then dress the wheel. *—R. J. Carabin, San Antonio, Texas.*

How Much Coal Will Your Bin Hold?

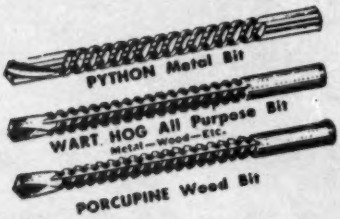
A CUBIC foot of soft coal weighs 50 lb., a cubic foot of anthracite 53 lb. You can find how many pounds your bin holds by multiplying its cubic capacity by one of these figures.

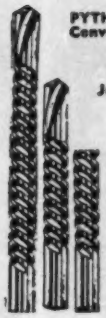
MILLER ROTARY

HI-SPEED ROPE-SAW DRILL-BIT

IT SAWS CUTS REAMS

Presents The Big 3





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$1.95 EA.—3 FOR $5.50
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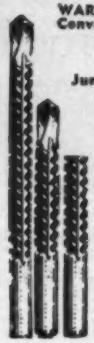

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1 JUNIOR
1 ROUTER
$8.50
SPECIFY TYPE
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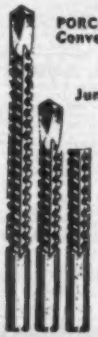
WART HOG
PORCUPINE



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SAWS, CUTS, REAMS sheet metal, angle iron, pipe, wood, plastic, Transite, etc. Amazing high-speed combination bit and saw fits any ¼" or ½" electric drill or slow drill press. Drills own starting hole to quickly cut, saw or ream opening. Easy to operate. Ideal for carpenters, auto mechanics, electricians, plumbers, hobby workers, many others. Abrasive resistant high speed steel. No breaking. Will withstand severe continuous use. Resharpened at no charge. ¼" diameter. Conventional Drill length 3½" with 2" cutting section. Junior Drill length 2⅜" with 1" cutting section. Router Bit length 1¾" with 1" cutting section. Ground from solid. Shipped same day—money back guarantee. Discounts on quantity orders from dealers. Takes place of up to $50 in tools. SEND CASH, CHECK OR M. O.

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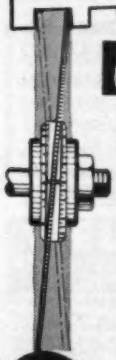

NEW *Warren* DADO SAWING WASHERS

Multiply the uses of your circular saw with sensationally improved Warren Dado Sawing Washers! Make smooth, parallel dados or grooves in *40 different widths* with your present saw blade! Dial the width with Micromatic adjustment—in 15 seconds you're making the cut. Four simple washers—precision-made in matched sets—no vibration, no gadgets to get out of alignment. No burning, chewing—no sanding. Four sizes ½", ⅝", ¾", 1"—fit all popular saw arbors. See your dealer or send coupon today—ABSOLUTELY GUARANTEED!

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New 12-ft. 48-strand, ⅛" galv. steel cable. 1000-lb. strength. 14-in. turnbuckle. Guy, strengthen . . . gates, fences, buildings, wagons, television towers, etc. Cost Gov't. $1.10 each. Special—10 for $3.89
50 for **$16.47;** 100 for **$29.32.**

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- **Bronze Nylon Roller Pressure Pump.** Stainless steel shaft. Pipe thread. Self priming. Positive displacement.
  ½" up to 100 PSI, over 5 GPM. $14.50
  ¾" up to 150 PSI, over 8 GPM. $20.95
  1" up to 150 PSI, over 17 GPM. $27.95
- **Low Cost Centrifugal Pump,** over 18 GPM. . . . $6.89
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(Write for free pump circular. Give details your problem.)

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- **Build Your Own Compressor.** 1-cyl. piston compressor, stainless 13"x25" tank. 160-lb. gauge, paint spray gun, blow gun, tire chuck, 15' hose, fittings and manual. $36.90
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- All-brass 14-foot boom, 4-row, tee jets, bronze direct-drive gear pump, etc. Cost $139.50. . . . . $69.90

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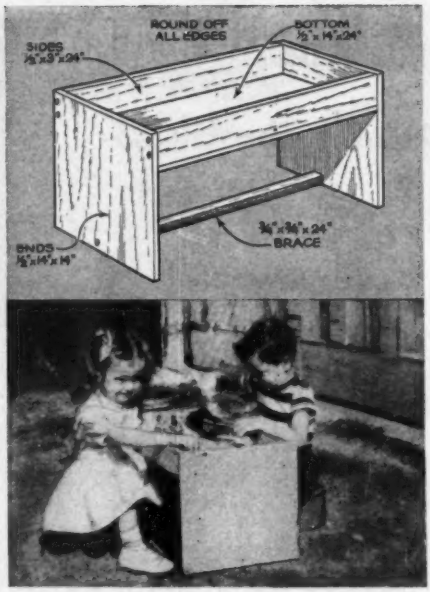

Sand Table Is Portable

WHERE can children who live in city apartments dig? Mine have a portable sand table that fits in a corner of their playroom, yet is light enough (including 10 or 15 lb. of sand) for their mother to move out to the courtyard. The simple way it was built is clearly shown. Only five pieces of ½" pine and a ¾" square brace are needed. All joints are screwed butt joints.—*Herbert Pfister, The Bronx, N. Y.*

Iron Block Is Good Drill-Press Pad

OLD-TIME machinists say that a piece of cast iron about 1" by 4" by 4" still makes the best drilling block. Unlike a wooden block, it will not raise burrs to throw the work out of line, it is heavy enough to hold its position on the drill-press table, and it can be used for a long time.—*Roy McGuckin, Ridgewood, N. J.*

Bluing Detects Tank Leaks

I COULDN'T tell whether our toilet tank was leaking or sweating. So I poured a little laundry bluing in the tank. Then when I saw that the drops of water from the tank were blue, I knew the tank was leaking. Sweat from the outside of the tank would not have been colored.—*Fred Lettino, Astoria, N. Y.*

Sands, Cleans, Smooths, Polishes Electrically

Designed for industry, for professional work, this light, beautifully balanced, orbital-motion, SpeedSander is rapidly becoming a standard home appliance. With its powerful electric motor and all-ball-bearing construction, anyone can easily re-surface and refinish furniture, woodwork, metal surfaces or walls. It will quickly remove old paint, stain, or enamel down to the bare wood or metal; will sandpaper to a "piano finish"; remove rust and corrosion or "feather edge" a scraped fender. It will burnish pots and pans or with lambs wool bonnet, delicately polish fine furniture. It makes tedious, tiresome jobs fun—saves hands! In design, convenience and efficiency it is today's finest sander regardless of price. Ask your local dealer to demonstrate it.

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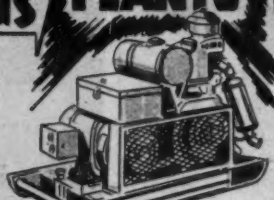

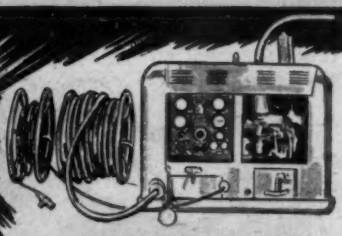

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300 WATT, 110-220 volt AC, 60 cycle light plant powered by 1 HP gas engine, direct drive. Mounted base weight 40 lbs. Just right for bomb shelter or P.A. system. New, stock #409..... **$99.00**

750 WATT, 110 volt AC, 60 cycle, direct drive, air cooled, Briggs & Stratton gas engine. Model AP. Pioneer generator, radio filter, self exciter, rope start. 190 lbs., 20" long, 17" wide, 16½" deep with carrying handle. New, stock #373..... **$232.00**

2500 WATT, 115 volt AC, 60 cycle, single phase, ENGINE: Briggs & Stratton, air cooled, 6½ HP. GENERATOR: Kurtz & Root or Leland, belt drive. Complete with $30.00 worth of spare tools, instructions and fully GUARANTEED. Was formerly priced at approximately $710.00. NOW priced for you NEW, as surplus, at only..... **$345.00**

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3000 WATT, CONTRACTOR'S PORTABLE. Briggs & Stratton 5 to 7 HP gas engine with Delco generator and rubber tired wheels. Rope start, weight 275 lbs. Used like new at **$220.00** **$279.00**
NEW

5000 WATT, 120 volt AC, 60 cycle, HERCULES 4 cycle gas engine. Generator manufactured by Hobart Bros. Unit includes remote control cable, 150' 2-wire #6, and 150' 3-wire #18, exhaust pipe, power cable plug. KVA at 80% power factor, radio and television filtered. Unit is completely automatic. List price today ..... $1910.00. Now priced for you at **$675.00** used, NEW **$895.00**

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Gas or electric. Awarded from government.

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2 HP	50 gal. tank	295.00
3 HP	60 gal. tank	410.00
5 HP	60 gal. tank	485.00
7½ HP	80 gal. tank	675.00
10 HP	80 gal. tank	775.00

and other bargain items

HEAVY DUTY GRINDER 1 HP, 1800 RPM, 3 phase, 220 Volt 60 cycle, 20 ft. cord. 24" Long. GUARANTEED. Mfg. by Thor & Chicago Pneu. Special SALE PRICE.....**$29.50**

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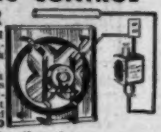

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PORTABLE HEATERS for Contractors Lauson gas engine with supercharger blower **$179.00**
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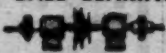

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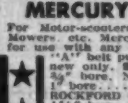

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300 Watt, RPM 3400, 110 and 220 volt, ½" shaft, $40.00; 2500 Watt, RPM 1800, 115 volt, AC, $295.00; 3000 Watt, RPM 2800, 110 volt DC, Delco ball bearing, 1" shaft. List $343.00 to you at only **$99.50**

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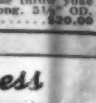

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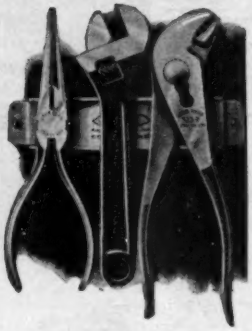

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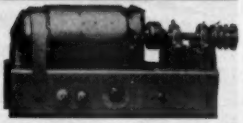

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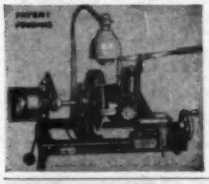

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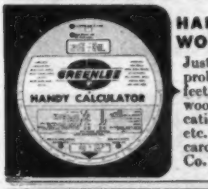

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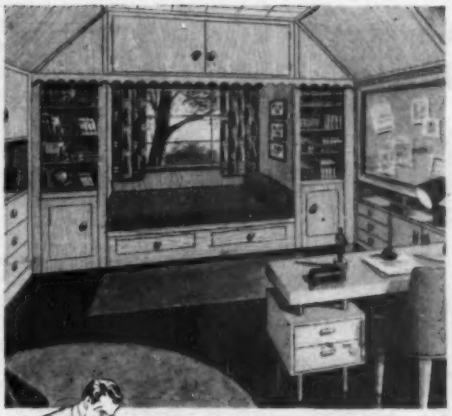

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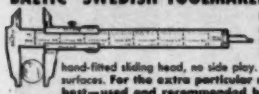

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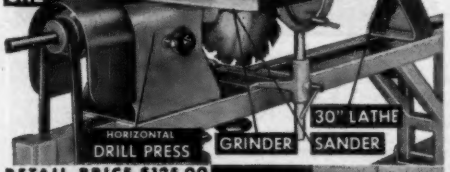

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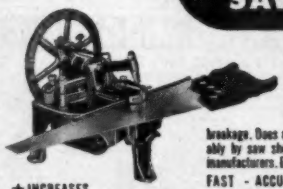

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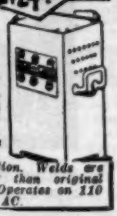

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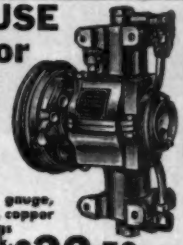

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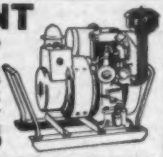

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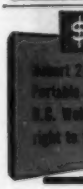

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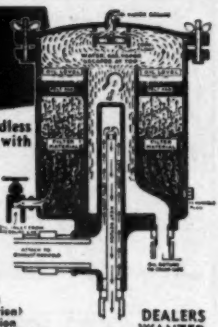

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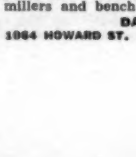
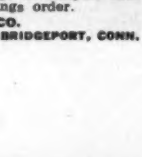


CASTINGS BLUE PRINTS BUILD YOUR OWN MACHINE TOOLS!



Catalogue with complete construction drawings of this bench milling machine or six inch shaper 25 cents per set postpaid or send one dollar for drawings of shaper, four millers and bench lathe. Refund on castings order.

DAVID JONES MACHINE CO.
1064 HOWARD ST. BRIDGEPORT, CONN.

SAVE UP TO 85% IN WAR SURPLUS from "GADGETEERS" HEAVEN

AAF FLEECE LINED JACKET

Will keep you warm & comfortable in the roughest weather. Fur lined throughout sleeves & body. 2 slash pockets & hvy duty zipper. Ideal for Farmers Ranchers, Hunters and Mechanics.

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NAVY WADING SUIT

Makes Surf & Deep Stream Fishing A Pleasure! Ideal for ranchers, oil fields or anyuse where it is necessary to protect body or clothes from moisture, silt, muck, etc. Made of rubberized canvas. Has vulcanized seams & built-in, rubber gloves and boots. Cost Gov't $60.00 Small – Medium & Large **6.95** Converted to waist length with bib & suspenders. . . . **8.95**

AAF CASE

Genuine top grade leather. Multi-compartment. Lock and Straps. Ideal for Artists, Students, Salesmen, etc. Used, good condition. . . **7.95**

AIR CORPS BRIEF CASE

This is a genuine piece of AAF equipment. Made of best grade Brown Leather in a handsome Pebble finish with a light canvas liner. Has two full length map or paper compartments and three smaller pockets. An ideal case for students, salesmen, artists, etc. Full heavy duty zipper closure. 12" x 16" Shpg. Wt. 3 lbs. ONLY **2.95**

CHEMISTRY SET

Made for Chemical Warfare Division for testing water, etc. A handy addition to the chemistry lab. or an exciting experiment for the amateur. Set includes test tubes, complete instructions, 15 different items. Packed in attractive lucite box with cover & dividers. Set **$1.39**

PLEXI DOME

Overall length 21" - Width at widest point 11" - at base 4". 6" deep. For Fish & Flower Bowls - Cab Roof - Lights. **1.89**

GOOSENECK LAMP

Consists of 24 volt control box with dimmer switch, 18" flexible extension & frosted glass shade. Can be used on 110 volt current. **2.79**

NAVIGATORS LAMP

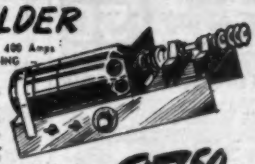
A handy light for desk, work bench, chart table, engine room, etc. Can be used on 6-12-24-110 V by changing bulb. 3 ft. shaft has 4 joints to adjust position. ONLY **3.29**

Sealed Beam LAMP

U.S. Navy Portable Pistol Grip light. Has sealed beam and aiming sight. Ideal for search, spot or Emergency light on auto, boat, farm etc. . . . . .

12 Volt light, 4" lens **3.29**
24 Volt, 5" lens & carry case . . **3.79**
Set of 3 filters, Red, Grn, Amber - (specify type lamp) . . . . . **99¢**

NEW! STATIONARY or PORTABLE D.C. ARC WELDER



300 Amps Continuous. 350 – 400 Amps Intermittent. For ALL WELDING LIGHT or HEAVY!!

This rugged air-cooled precision built electric ARC WELDER – designed to weld for hours comes complete with pulley reactor, output controls, Hi-Lo switches, rheostat. The heart of this unit is the famous R-1 generator, specially developed for B-29 Bombers, and with features no other generator has. Heavy steel frame, easily adapted to mounting on Jeep, Tractor or other power supply (10 H.P. gas or electric). Never before offered at this low price.

97.50

NEW WATCHES

NEW WATCH . . . Here's a real shock absorbing watch. Has jewel movement, sweep second hand, luminous dial, chrome case. Guaranteed for one year. Ideal for young and old. **6.95**

WALTHAM NAVIGATION WATCH. (Type A-8) An ideal timer for following at horse racing, boating or any other sports event where split-second timing counts. Large dial with sweep second hand counts the seconds in 1/10ths. Small dial records up to 5 minutes. Originally designed for aircraft navigation. THIS IS A TREMENDOUS BUY!! Plus 10% FED. TAX **22.50**

17 JEWEL CHRONOGRAPH One of the finest made anywhere. Cased in Switzerland. Sweep second hand, stop and re-set button. Measures distance, airspeed, groundspeed, races. Ideal for the sportsman. **26.95**

17 JEWEL AUTOMATIC WRIST WATCH . . . Swiss made men's wrist watch. A real self-winding watch. . . winds itself while you wear it. Incablac (shock protected). Silver white or black face. Waterproof nickel chrome case. Stainless steel back. Hours marked in numerals. Genuine leather strap. Red second hand with arrow tip. Guaranteed **26.95**

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LINEMAN'S KIT

– Type used by U.S. Army Signal Corps. Consists of pair of heavy duty lineman's pliers with pipe jaws & side cutters – a fine quality 2 bladed wire-skinning knife. In regn. Signal Corps leather pouch. **2.39**

NEW TARPS - HEAVY CANVAS

Mildew & Flame Resistant. Cheap outside storage! They are really moving at these prices.

5' x 7' $3.95
11' x 16' 17.00
16' x 32' $1.20

Rubberized Nylon Tarp 7' x 11' **6.95**

New Rubberized Linen Tarp – 7' x 11' Waterproof, weighs only 3 lbs. Ideal for outside car storage . **5.95**

18 OZ. TARP – 6' x 6' – O.D. Duck Can be used as a tent floor covering or storage protector. A terrific buy! Used – but in excellent condition **3.95**

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Telephone type – Highly Sensitive with excellent, clear tone. This was the Signal Corps favorite. An ideal instrument for the radio 'ham' and professional recording studio, broadcasting, home recording, public address, etc. A Sensational Buy! Complete with cord and plug. . . . ONLY **2.69**

RADIO HEADSET

Low Impedance. Ideal for amateur radio, crystal sets, or professional use. Adjustable ear phones. Used and in excellent condition. . . **1.69**

FOAM RUBBER

Moulded, pre-shaped. Can be cut to fit your chair, boat, truck, auto or trailer seats. Ideal for all sports events.

25" x 66" x 1½" thick $8.95
25" x 60" x 1½" thick $8.90
18½" x 20½" x 4½" thick $6.45
35" x 21" x 6" tapered to 4" . . . $11.95

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3" Cored Stock . . . . No. 2½ compression ideal for cot, bed, bunk, couch or chair.

3" x 44" x 80" $59.50	3" x 44" x 49" $33.50
3" x 22" x 80" $33.50	3" x 22" x 40" $17.50

1" x 44" x 40" $14.50
2½" x 44" x 40" $31.00
4½" x 44" x 40" $47.50

LEATHERETTE

Genuine LEATHERETTE to cover Chairs, Patio Furniture, Hooks, Auto Seats, etc. – 10 COLORS – at a BARGAIN PRICE

WIDTH	COLORS	PER YD.
36"	tile, red, brn., black	$1.19
36"	lt. grn., dk. grn., blue . .	$1.45
54"	(approx.) red, brn., lt. blue, ivory and yellow	$1.95

PRESSURE TANKS

1000's of uses around farm, shop & factory for storage, pressure, paint & insecticide spraying, etc.

F-2 – 6" x 45" — (1000 cu. in. capacity) – Stainless Steel **4.95**

F-2A – Same as F-2 but in Corrosion resistant steel **3.95**

D-2 – 6½" x 24" — (500 cu. in. capacity) – Stainless Steel **3.49**

D-2A – Same as D-2 but in Corrosion resistant steel **2.49**

TANK

Dural with welded seams, 2" filler with cap, two standard pipe parts for hookup. Visible liquid level gauge on side. Ideal for Gas, Oil, Water, or "spare" on auto, tractor, truck or boat. Sturdy, light. Capacity 6 gals. **14.95**

NEW 1951 CATALOG

PACKED WITH BARGAINS!!!! Just ON The Presses! Bigger Than Ever! 200 Pages of NEW and SURPLUS Clothing, Tools, Camp Equipment, Electrical Supplies, Hydraulics, Motors, Pumps, Valves, Raw Stock, etc.

AT UNHEARD OF LOW PRICES! Send 50¢ Today! (refunded with your initial order of $1 or more)

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Fine grade leather – Chamois lined with chin cup on strap. Intermediate weight – Ideal for summer wear. NEW ONLY . . **1.59**

All Wool Winter type with fleece or chamois lining. Has ear puffs & chin cup. Ideal for pilots, cycle – drivers, sportsmen, etc. **1.95**

GOGGLES

Aviators (AN-6530) Windproof & Dustproof

Rubber or chamois covered frame. Clear or Green GROUND LENSES are inter-changeable. Adjustable nose bar. Ideal for flying, motor cycling, etc. **1.69**

GO-1 GOGGLE KIT

NEW! U.S. Navy – Has soft sponge rubber frame. 4 Polaroid lenses 2 green, 1 red, 1 clear. Perfect for racing, cycling, at **89¢**

RUBBER BOOTS

A sturdy boot of the finest pliable rubber. Completely water-proof with adjustable strap. Can be worn with or without shoes. A REAL BUY **3.95**

SHOE PACS

Assures complete foot and shoe protection in the coldest weather. Specially designed to keep the feet warm & comfortable & the shoes dry. Has 14" leather boot top, rubber shoe & sole – felt inner sole. **3.95**

Plexiglass & Nascolite clear plastic shts.

NASCOLITE – Full sheets app. 1/8" x 37½" x 49½", app. 109 lbs. each **$14.25**

PLEXIGLAS – Full Sheet 3/16" x 36" x 48" Per Sheet . . **$17.95**
5/16" x 36" x 48" . . . Per Sheet **$27.50**

Fabricators write for our special quantity prices. All above are new & tested. Also inquire about other large stocks of Plastics.

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with knobs and rubber pads for non-slippage on each section. A must for navigators, mechanics, draftsmen and engineers.

You've never seen 'em at . . . . **97¢ ea.**

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7 x 50 with case

Lightweight but sturdy. Navy type. Full 50mm objective lenses that insure maximum brightness and sharp definition. Finely balanced for easy handling extra wide field of view, individual eye-focusing. With genuine leather case **33.95**

NYLON FISHLINE Special

Strong – Lightweight – 2 ply NYLON FISHING LINE ROT PROOF and WATERPROOF . . . Especially treated for strength and long life. ON SPOOLS.

1500 ft. 25 lb. test - wht. $1.86
1500 ft. 10 lb. test - blk. $1.42
1000 ft. 25 lb. test - grn. $1.64
2500 ft. 10 lb. test - brn. $1.86
750 ft. 50 lb. test - brn. $3.18
400 ft. 50 lb. test - brn. $1.31
750 ft. 45 lb. test - grn. & brn. . . . $2.96
300 ft. 100 lb. test - wht. $4.36
300 ft. 75 lb. test - silver gray . . . $3.51

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BUILD YOUR OWN TILTING ARBOR SAW!

SAVE $50 OR MORE

Exclusive GIL-BILT Build-It-Yourself Features

- No machining—build easily with hand tools only
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- Sturdy wood, aluminum, and steel construction
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GIL-BILT 10-INCH TILTING ARBOR SAW

- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34" high table always stays level
- New Departure ball bearing arbor, ¾" precision shaft turned down for ⅝" bore blades, alum. housing, shipped ready to run
- Jackscrew and 4½ in. dia. handwheel lowers and raises blade
- Cast aluminum miter gauge and self-aligning rip fence guide

GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jackscrew mechanism and handwheel, and all other metal parts (less blade) $20.95
Same Kit with 10" Combination Blade . $24.90
Same Kit with 8" Combination Blade . . $23.90

GIL-BILT BELT SANDER

- 84 sq. in. sanding surface. Over 4 times the effective area of a 10 in. disc sander.
- Belt operates in either vertical or horizontal position, does all sanding operations.
- Driver drum and pulley turn on sealed New Departure ball bearings; tension drum turns on Chrysler Oilite bronze bearings.
- Spindle and tension mechanisms of cast aluminum, completely machined and assembled.
- Belt travels 1800 ft. per min. Over a MILE of straight sanding action every three minutes. Saves more "elbow grease" than any other tool.
- GIL-BILT Metal Parts Kit includes Plans, ball bearing spindle, 4 in. driver drum, 3 in. tension drum, tension mechanism, table tilt segments, rubber tires, cloth sanding belt, and all other metal parts $16.95

GIL-BILT 12-INCH BAND SAW

- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings; Upper wheel runs on two ⅝" bore Oilite Bronze bearings
- Upper wheel tension and tilt mechanism of cast aluminum, completely assembled
- Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws.
- Rigid cast aluminum wheels fully machined ready-to-install. Heavy rubber tires.
- Uses standard 78 inch blades up to ⅜ in. wide.
- Fully enclosed mechanism for utmost safety.

GIL-BILT Metal Parts Kit includes Plans, rubber tires, aluminum wheels, ¼ in. blade, ball bearing spindle, tilt mechanism, blade guides, table tilt segments, and and all other metal parts $20.00

Return Kits in 10 days for refund if not satisfied.
(Prices include postage within 600 miles. Over 600 add 5%)

Also available—Plans and Parts Kit for 8" Tilt/Table saw. Order Plans at $1.00 each—sent postpaid anywhere in the world or write for FREE descriptive catalog.

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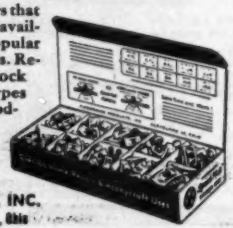
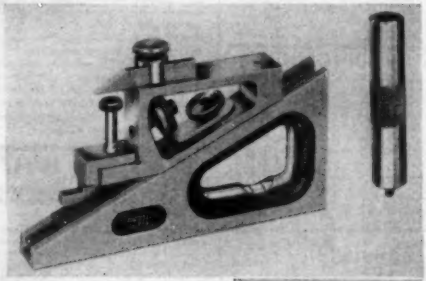
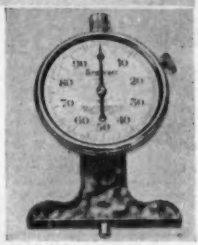


TINNERMAN PRODUCTS, INC.
Dept. 13-4, Box 6688, Cleveland 1, Ohio

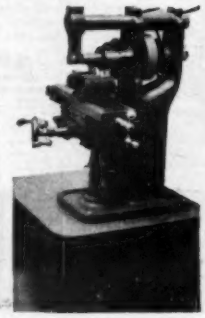
New





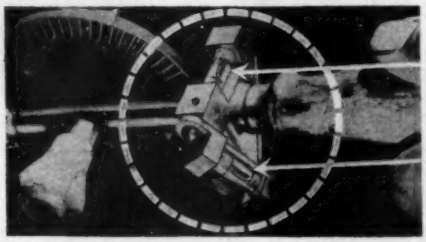
New Gauges. These two tools—a precision gauge above and a dial indicator at right—are both made by the L. S. Starrett Company, of Athol, Mass. The precision gauge is adjusted to size by turning the knurled thumb screw. A clamp nut locks the slide in position. Both thumb screw and clamp nut are narrower than the gauge's thickness, permitting the gauge to be used on its side. The gauge is ¾" wide and 5¼" long. Capacity without extensions is 7". A level is built in the base of the gauge.

The dial indicator—designed for measuring the depths of holes, slots, and recesses—has a range of from zero to 3". Twelve measuring rods from ¼" to 3" long are furnished with the gauge. Measurements are registered on the dial in .001".

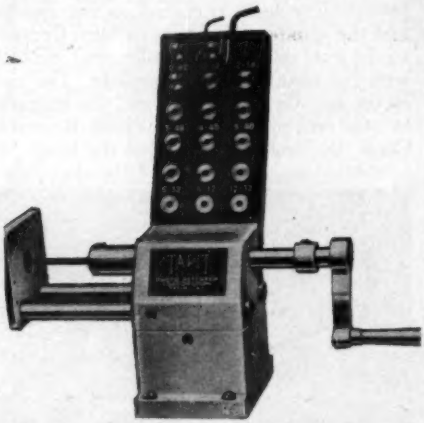


Small Milling Machine. Small to medium milling jobs can be handled on this machine. The table has a working surface 3½" by 16". Feeds are: transverse, 4"; vertical, 8"; and longitudinal, 11". Height is 26" and weight 200 lb. L. H. Minton, of Seattle, is the maker.

Tools



Three-Bubble Level Fits Hand Drills. It's easier to drill straight or angled holes with this attachment clamped to your drill. Two of the levels are fixed. The third level —calibrated for angles—can be locked in any of three positions. Weight of the aluminum unit is 2 oz. Singer Kennedy Corp., of Chicago, is the maker.



Hand Tapping Machine. The twin guide bars of this tool hold taps in exact alignment with the holes in the work, and the adjustable collar on the crankshaft can be set for the depth of the hole to be tapped. The panel that holds the collets and wrenches can be removed from the machine. You can operate the tool on a bench, or you can remove it from its base and lock it in a vise or take it to the work. Photo Research Corporation, of Burbank, Calif., manufactures the tool.

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the most stubborn

nuts

as the experts do

Tens of thousands of mechanics in plants and service shops rely on famous Snap-on *professional* tools in earning their livings. Snap-on Boxockets are special favorites. Drop-forged, heat-treated. Incredibly strong, with machined openings, "streamlined" for close work. Properly offset for knuckle clearance. Beautifully finished, as fine tools deserve. Snap-on Boxockets will serve you for years. Make you proud of your kit. Make you sure and confident on any job. If you are a user of quality tools, send for free 104-page catalog.

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don't lose an eye!

There's no second helping when it comes to eyes. Don't gamble with 'em. Save yours from flying wood or metal particles—chips, sawdust, sparks. Wear this MonoGoggle when you are drilling, sanding, grinding. The MonoGoggle gives you complete eye protection. One-piece, wide vision, plastic lens has high impact strength. The molded frame is flexible—fits your face comfortably. The MonoGoggle weighs only about an ounce and you can wear it, even over prescription glasses, for long periods. Get yours now. Fast delivery from the factory. Send check or money order to

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I enclose $_____. Send me_____MonoGoggle (s) postpaid. _____Send descriptive bulletin.

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- 2-1 reduction prevents burning saw teeth on metal!
- NO GEARS, NO BEARINGS—ABSOLUTELY NOTHING TO WEAR OUT!
- LIFETIME GUARANTEE—At any time, we'll put this tool in perfect working order for only 75c!

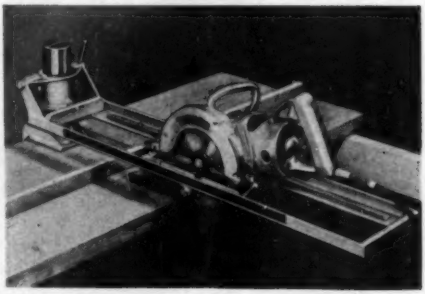
SEND CASH, CHECK, OR MONEY ORDER TODAY.

Bertrum G. Engineering & Supply Co.

3121 Main Street Kansas City Mo.

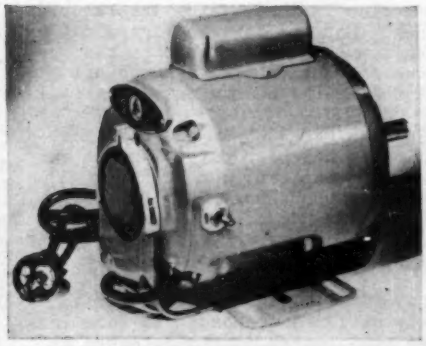
New Tools

Shaper Head Cuts All Shapes. Any style of molding can be duplicated in a few minutes with this shaper head. On opposite sides of the head are a series of sharp blades. Templates—cut to the shape you want—are slipped into slots behind the knives, as shown in the photo above. Then the retaining plate and upper plate are replaced. The head is placed on the spindle and the spindle given a sharp turn. Centrifugal force throws the blades into contact with the contour of the template. The nut on the spindle is tightened and you're ready to start cutting molding. Photo Research Corp., Burbank, Calif., makes the head.



Portable Saw Converted to Radial Saw. In use, this 26-lb. guide for a portable saw is attached to a platform across two saw horses. With that setup, you can make cross cuts, beveled cross cuts, miters, beveled miters, rips, and beveled rips. Bevel capacity is 0° to 45°. It's made by Skilsaw, Inc., Chicago, for three of their models and for other makes with base width capacities of 4 13/16" to 5⅜".

Ball-Bearing Center. A double row of sealed ball bearings takes the radial and thrust loads on this center. The shank has a No. 2 Morse taper. The accessory—designed for use on lathes, grinders, screw machines, and gear hobbers—is made by the Power Tool Division of the Rockwell Manufacturing Co., Milwaukee, Wis.



⅓ Hp. Motor Reverses Instantly. This single-phase motor starts in either direction, reverses instantly, and can be stopped abruptly or allowed to stop normally. It operates on 115 volts and turns up 1,725 r.p.m. at full load speed. Iron Fireman's Heating Control Division, Portland, Ore., makes the motor.

For the best in tools . . .

buy MILLERS FALLS

If you want the very best, ask your hardware dealer to show you these beautiful new Millers Falls tools. See, too, the many other Millers Falls hand and portable electric tools he is now displaying. They're the finest line in Millers Falls 83 years of quality toolmaking. Millers Falls Company, Greenfield, Mass.

MILLERS FALLS TOOLS
SINCE 1868

The Mark of Superiority

P.S. Last minute news & notes...

RUSSIA "does have" the atomic bomb, the Atomic Energy Commission Chairman, Gordon Dean, says flatly when others express doubts about it.

AMERICA is building more plants to produce more atomic arms. What you can do in your own home about atomic defenses is stressed in POPULAR SCIENCE this month.

MOST IMPORTANT part of your body to shield from A-bomb radiation is probably your head, report University of Chicago doctors who have been experimenting with dogs, rats, and mice. When they protected their dogs' heads with a quarter inch of lead, 15 out of 20 dogs survived X-ray doses that otherwise would have killed all of them.

ATOMIC ENGINEERS now say (1) progress has been made in developing materials needed to build nuclear reactors for peace-time purposes, but (2) building and running such atomic power plants for industry would cost too much--partly because of the high cost of secrecy.

IT COSTS LESS to burn coal or oil than it would to use uranium now. The engineers still hope, however, to develop atomic engines that will yield more fuel than they consume. Breeding fissionable material this way would lessen the dependence of atomic power plants on the uranium miners and prospectors. But separating the fresh fuel from the ashes would cost a wad of money.

CHEMICAL ENGINEERS are striving now to discover new, safer, and cheaper ways to sort out the many kinds of radioactive material that are created when uranium atoms split. This might substantially reduce the cost of running a breeder, and make the construction of industrial reactors much more desirable.

ALUMINUM seems likely to be one of the first industries affected. Vast amounts of electricity are needed to produce aluminum, and the demand for aluminum has been increasing. By 1970, the aluminum makers may need so much juice that some of it will have to come from generators driven by atomic energy.

MORE EMPHASIS right now is being placed, the AEC chairman has hinted, on ways to propel a ship with atomic power than on other nonexplosive uses for it. The AEC has ordered two land-based prototypes for marine engines built. If successful, such engines could be put in submarines.

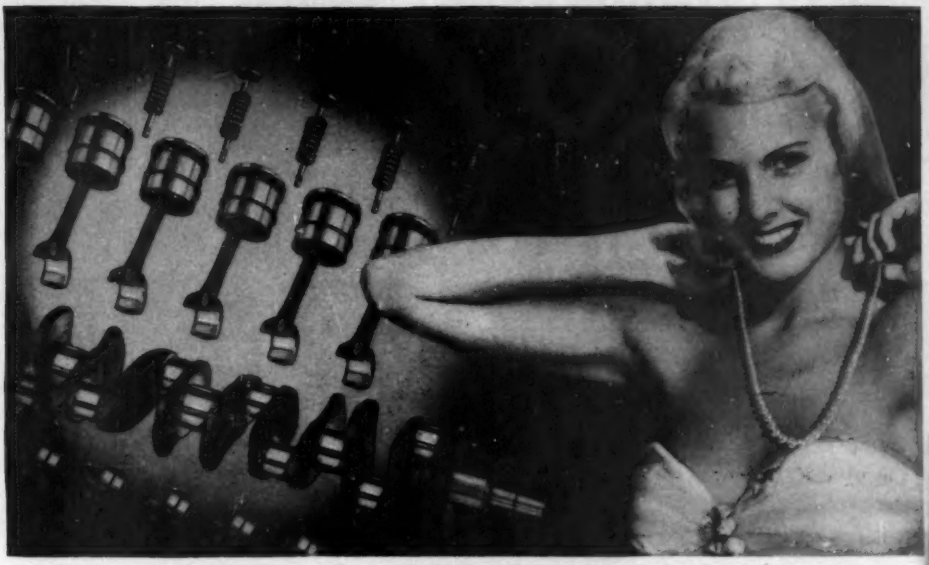
RADIATION detectors are being improved, too. One of the latest developments is a pocket meter that sounds an alarm whenever you are getting too much.

MORE KNOWLEDGE of what really holds the nuclei of atoms together might make it easier to solve the nuclear engineers' problems. Mesons may account for atomic phenomena. Six different kinds of mesons are being studied in the physics laboratories now. But the men who figure out things of this sort are baffled by the findings of the men who are knocking the mesons out.

POSTWAR RESEARCH in basic science already has been put to use in our weapons program, according to AEC Commissioner Henry DeWolf Smyth. But he and other scientists fear that its importance may be forgotten in the mobilization rush.

NATURE still is more powerful than any nation's weapons. To turn loose as much energy as was released by earthquakes alone last year, Russia would need 4,000,000 atomic bombs. There were 796 quakes in 1950. But they were not aimed at cities. The greatest one (in Asia) is estimated to have taken only about 5,000 lives.

The Editors



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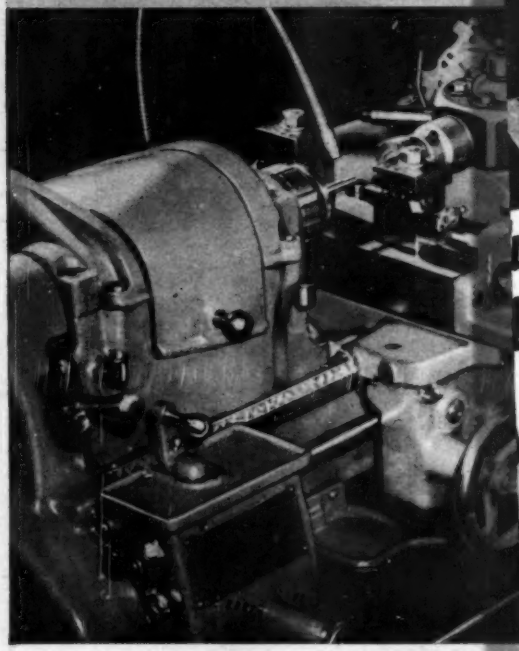

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